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# OPERATION EXPERIENCE WITH THE
# CONSPEC REMOTE MONITORING
# SYSTEM IN AN
# OPERATING UNDERGROUND CANADIAN
# COAL MINE

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# TABLE OF CONTENTS

Page

ABSTRACT

FOREWORD

CHAPTER 1 - INTRODUCTION

1.1 Study Location................................ 1
1.2 History of Remote Monitoring at CBDC......... 3
1.3 Scope of Study................................ 5

CHAPTER 2 - DESCRIPTION OF CONSPEC SYSTEM AT LINGAN MINE

2.1 General Description.......................... 7
2.2 Detailed Description......................... 9
    2.2.1 Central Monitoring Station............ 9
    2.2.2 Typical Wall Outstation............... 12
    2.2.3 Transducers........................... 14
    2.2.4 Software Capabilities................. 19
        2.2.4.1 Senturion 200 Software......... 20
        2.2.4.2 Quay 910 Software.............. 26
2.3 Installation Activities...................... 28
2.4 Maintenance and Operational Procedures....... 32

CHAPTER 3 - COMPARISON OF CONSPEC AND TRANSMITTON SYSTEMS

3.1 Transmitton System at No. 26................. 35
    3.1.1 General Layout........................ 35
    3.1.2 Central Monitoring Station............ 36
    3.1.3 Outstations and Transducers........... 38
    3.1.4 Software Capabilities................. 40
    3.1.5 Installation Activities............... 43
3.2 Comparison of No. 26 and Lingan Systems...... 44
3.3 Transmitton System at Prince................. 45
    3.3.1 General Layout........................ 45
    3.3.2 Central Monitoring Station............ 47
    3.3.3 Installation Activities............... 48

CHAPTER 4 - SYSTEM PERFORMANCE

4.1 Transducer Performance....................... 50
    4.1.1 Assessment Method..................... 50
    4.1.2 J-Tec Airflow Monitors................ 52
    4.1.3 BM1 Methane Monitors.................. 57
    4.1.4 J-Tec Gas Flow Monitors............... 58
    4.1.5 BM2H 0-100% Methane Monitors.......... 59
    4.1.6 Air Temperature Transducer............ 61
    4.1.7 Barometric Pressure Transducer........ 61

## TABLE OF CONTENTS (cont'd)

Page

4.1.8 Fan Water Gauge Transducer............ 62
4.1.9 Mechanical Transducers................ 62
4.2 Airflow Transducer Tests.................... 65
4.2.1 J-Tec Lab Calibration................. 65
4.2.2 J-Tec Mine Calibration................ 66
4.2.2.1 Specified Method................ 66
4.2.2.2 Alternative Method............. 68
4.2.2.3 Comparison of Calibration Methods...................... 69
4.2.3 Trolex Airflow Monitor................ 70
4.2.4 Sieger BA5 Airflow Monitor............ 72
4.2.5 Effect of Time Constant Dampening..... 73
4.2.6 Recommendations...................... 74
4.3 Computer Performance........................ 75
4.3.1 Assessment Method.................... 75
4.3.2 Hardware Performance.................. 75
4.3.3 Software Performance.................. 79
4.3.3.1 Senturion 200.................. 80
4.3.3.2 Quay 910....................... 83
4.4 Management Usefulness....................... 86

**CHAPTER 5 - 9 EAST STUDY**

5.1 System Description.......................... 90
5.2 Data Acquired............................... 92
5.3 Problems Encountered........................ 94
5.4 Usefulness as a Research Tool............... 96

**CHAPTER 6 - CONCLUSIONS AND RECOMMENDATIONS**

6.1 Conclusions................................. 99
6.2 Recommendations to CBDC..................... 100
6.3 Recommendations to Conspec.................. 101

**REFERENCES**

**LIST OF MANUFACTURERS**

**FIGURES**

**TABLES**

**PHOTOGRAPHS**

**APPENDICES**

# LIST OF FIGURES

1. Schematic Layout of Lingan Monitoring system
2. Schematic layout of Central Monitoring Station
3. Schematic Layout of Wall Outstation
4. Index Plan of Lingan Mine
5. Outstations and Central Monitoring Station-Location Plan
6. Surface - Transducer Locations
7. Pump Station - Transducer Locations
8. 6 West, 8 East, 10 East and 2 Deep Doors-Transducer Locations
9. 9 East and 9 East Canmet Study - Transducer Locations
10. Schematic Layout of Senturion 200 Control Terminal Screen
11. Portion of an Event Log
12. Portion of an All Points Log
13. Portion of an Alarm Summary
14. Portion of a Descriptor List
15. Portion of an Accessor List
16. Portion of an Analog Data Report
17. Portion of a Correction Factor - Offset Table
18. Portion of Trend Log
19. Shift Report
20. Process Display Outline
21. Trend Plot
22. Schematic layout of No. 26 Monitoring System
23. Schematic layout of No. 26 Central Monitoring Station
24. Monitor Screen Layout
25. List of Report Options
26. List of all Outstations
27. List of Alarms of an Outstation Type
28. List of Recent Alarms
29. List of Outstations of a Type
30. List Outstation Status
31. Graph of Analog Output
32. List of Analogs Selected for Graphs
33. List of Analog Transducers
34. List of Parameters of Analog Transducers by Outstation
35. List Status of a Group of Analog Transducers
36. List of Analog Groups
37. Schematic layout of Prince Mine Monitoring System
38. Schematic layout of Prince Mine Central Monitoring Station
39. J-Tec Calibration
40. J-Tec Calibration - Maximum Error
41. J-Tec Spon Adjustment
42. J-Tec Calibration Method

## LIST OF FIGURES (cont'd)

43. J-Tec Alternative Calibration Method
44. Trolex Lab Calibration
45. Trolex Lab Calibration - Maximum Error
46. Trolex Monitor Calibration
47. Sieger BA5 Lab Calibration - Velocity Ranges
48. Sieger BA5 Lab Calibration - 0 to 2 m/s Range
49. Sieger BA5 Lab Calibration - 0 to 5 m/s Range
50. Sieger BA5 Lab Calibration - 0 to 10 m/s Range
51. Sieger BA5 Lab Calibration - 0 to 20 m/s Range
52. Effect of RC Time Constant
53. Trend Plot for 9 East Top Level Methane (Aug. 27-29/86)
54. Trend Plot For 9 East Coal Road Methane (Aug. 27-29/86)
55. Trend Plot For 9 East Top Level Airflow (Aug. 27-29/86)
56. Trend Plot For 9 East Methane Drainage Volume (Aug. 27-29/86)
57. Trend Plot For 9 East Methane Drainage Concentration (Aug. 27-29/86)

## LIST OF TABLES

1. Summary of Main Transducer Types in Lingan
2. List of Operational Transducers - Lingan Remote Monitoring
3. Summary of System Commands for the Senturion 200
4. Outline of Lingan Installation Schedule
5. Summary of Main Transducer Types in No. 26
6. Distribution of Transducers by Outstation
7. Outline of No. 26 Installation Schedule
8. Comparison of No. 26 and Lingan Systems
9. Comparison of JTec Calibration Methods
10. Evaluation of J-Tec vs. Trolex Air Flow Monitor Performance
11. Performance of Sieger BA5 - Prince Mine - 7 East Top
12. Performance of Sieger BA5 - Prince Mine - East High Main
13. Summary of System Problems - Lingan

## LIST OF PHOTOGRAPHS

1. Lingan Colliery - Central Monitoring Station- Conspec System
2. Lingan Colliery - Central Monitoring Station- Conspec System
3. Lingan Colliery - Computer Rack - Conspec System
4. Lingan Colliery - Control terminal screen - Conspec System
5. Lingan Colliery - 10 East Wall Outstation - Conspec System
6. Lingan Colliery - Outstation accessor cards - Conspec System
7. Lingan Collier - Checking BM1 detector head with D6 methanometer
8. Lingan Colliery - BM2H sample lines
9. Lingan Colliery - BM1 and BM2H control units
10. Lingan Colliery - Checking J-Tec with hand held anemometer
11. Lingan Colliery - Checking J-Tec with extension handle anemometer
12. Lingan Colliery - J-Tec span control
13. Lingan Colliery - Photographic method of area determination
14. Lingan Colliery - J-Tec gas flow transducer
15. Lingan Colliery - Pumping station outstation
16. Lingan Colliery - Discharge water flow transducer
17. Lingan Colliery - 2 Deep Door position indicator switches
18. Lingan Colliery - 2 Hoist door indicator lights
19. Prince Colliery - Central Monitoring Station- Transmitton System
20. Prince Colliery - Computer Rack - Transmitton System
21. Prince Colliery - Computer Rack (rear) - Transmitton System
22. Prince Colliery - West Wall Outstation - Transmitton System
23. Prince Colliery - Sieger BA5 and control units
24. Prince Colliery - BM1, CO, and Sieger BA5 control units

# LIST OF APPENDICES

1. Performance of J-Tec Air Flow Sensors
2. Performance of BM1 Methane Monitors by Trend Log
3. Performance of BM1 Methane Monitors by Immediate Status
4. Performance of J-Tec Gas Flow Monitors by Trend Log
5. Performance of J-Tec Gas Flow Monitors by Immediate Status
6. Performance of BM2H Monitors by Trend Log
7. Performance of BM2H Monitors by Immediate Status
8. Performance of Air Temperature Transducer
9. Performance of Barometric Pressure Transducer
10. Performance of Fan Water Gauge Transducer
11. Daily System Performance Summary
12. Component Performance Summary
13. R.O.M. Production (Tonnes) as Reported by Lingan Colliery

# ABSTRACT

This report summarizes operational experience with the Conspec Remote Mine Environmental Monitoring System at Lingan Mine. The detailed description of the Conspec System includes descriptions of the major components in the Central Monitoring Station, the Outstations, major transducers, software features, and problems encountered during the installation and commissioning. A general description is also given for the Transmitton system that was installed at No. 26 Mine before it closed in 1984, and includes a comparison of it's main features with those of the Conspec System.

Detailed summaries of operational experience include a discussion of the major hardware and software problems, and the reliability and accuracy of environmental transducers as measured over a 12-month period at Lingan Mine.

The results of monitoring the ventilation on a particular longwall panel at Lingan over a period of 12 months are also summarized.

# Résumé

Le présent rapport résume brièvement la vérification du fonctionnement en condition d'exploitation du système de monitorage à distance de l'environnement Conspec à la mine Lingan. La description détaillée du système Conspec comprend en outre la description des parties constituantes importantes du système de monitorage central, des stations périphériques, des principaux transducteurs, des caractéristiques du logiciel et des problèmes encourus au cours de l'installation et de la mise en service. Une description générale du système Transmitton, installé à la mine N° 26 avant sa fermeture en 1984, et une comparaison entre les principales caractéristiques de ce système et celles du système Conspec sont aussi présentées dans le rapport.

Les descriptions détaillées de la vérification du fonctionnement en condition d'exploitation comprennent l'étude des principaux problèmes rencontrés au niveau du matériel et du logiciel, et de la fiabilité et exactitude des transducteurs environnementaux tels que déterminés à la mine Lingan pendant une période de 12 mois.

Les résultats obtenus au cours du monitorage de la ventilation des fronts de longue taille effectué sur une période de 12 mois à la mine Lingan, sont aussi indiqués dans ce rapport.

# FOREWORD

This report was prepared under Contract 03SQ-23440-5-9002 between Supply and Services Canada and the Cape Breton Development Corporation (CBDC). The work was carried out by the staff of CBDC's Mines Engineering Department at Glace Bay and at Lingan Mine near New Waterford, Nova Scotia. Dr. B. Konda of the Cape Breton Coal Research Laboratory (CANMET) at Sydney, Nova Scotia acted as scientific authority on the project.

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# CHAPTER 1.0 INTRODUCTION

## 1.1. Study Location

The Sydney Coalfield is located in the Sydney area of Cape Breton Island, Nova Scotia. Coal mining in this area dates back to the 1800's and since then has included at least 28 different mines. During the industry's peak around 1945, 12 mines were producing from 4 different seams. In the 1950's and 60's the industry suffered a major recession as the world's demand for coal was replaced by oil.

In 1967, the ownership of the 4 remaining mines was transferred from private interests to the Federally owned Cape Breton Development Corporation (CBDC). In 1987, CBDC now operates 3 underground mines - Lingan, Prince, and Phalen.

The present industry is still a major part of the local economy, employing a work force of about 3,600. Total coal production in 1986/87 was 2.6 million tonnes, of which about 73% was sold for thermal electric power generation by the local utility, and about 20% for export.

In April, 1984 a fire forced the closure of the No. 26 Mine. This Mine had been in operation since 1943, producing about 0.8 million tonnes annually from 2 advancing longwalls. At the time of closure, No. 26 had reached a depth of about 800 meters below sea level (B.S.L.).

Lingan Mine which opened in 1972 is now the oldest of the 3 operating mines in the area. It has a designed production capacity of 1.3 million tonnes from 3 advancing longwalls. In 1986/87 only 1.1 million tonnes were produced due to adverse geological conditions. Present operations are about 625 meters B.S.L.

Prince Mine opened in 1975 and is currently producing at a rate of 1.1 million tonnes per year (1986/87) from 1 retreating longwall face. It's workings are now about 230 meters B.S.L.

Phalen Mine is still under development, however early production from it's 1 west retreating long wall face began in May, 1987. Commencement of full production from Phalen of 1.5 million tonnes per year from 2 retreating longwall faces is targeted for 1989/90. This Mine is located in the Phalen seam, about 135 meters stratigrahpically below the Lingan Mine (Harbour Seam). Initial mining depths are about 350 meters B.S.L.

## 1.2 History of Remote Monitoring at CBDC

Although the remote environmental monitoring of underground coal mines is generally thought to have originated in Europe, the Cape Breton Development Corporation has made significant contributions towards it's implementation and development in North America. In 1976, CBDC implemented continuous CH4 monitoring of the coal face. Automatic stopping of the face conveyor upon a pre-set alarm from the CH4 monitor, was an idea conceived and developed by CBDC and is now standard practice in all of it's underground operations.

Implementation of a complete remote environmental mine monitoring system in the Cape Breton coal mines began around 1978 when CBDC engineers began to review their detailed requirements and the features of the systems which were commercially available at the time. The perceived benefits of such a system were:

1. The continuous monitoring of mine ventilation parameters would allow a faster response in dealing with any hazardous condition that might develop than was currently possible through the normal methods of periodic manual sampling. Thus the overall safety of the operations would be increased.
2. The continuous monitoring of critical mine equipment such as ventilation fans and methane drainage pumps would allow earlier warning of impending malfunctions and thereby the implementation of remedial measures.

3. By analysis of stored historic data it might be possible to develop improved operating practices.
4. The centralization of environmental monitoring data in one central location would facilitate management's ability to supervise and control a widespread underground operation.
5. With increased demand for higher productivities in the coal industry, application of mechanized and automated processes was necessary. Continuous remote environmental monitoring was considered to be the first step leading to the implementation of more advanced remote and automatic control technologies.

In 1980, CBDC decided to install remote monitoring systems underground at both No. 26 and Lingan. No. 26 was selected as the first site. After reviewing proposals from 5 suppliers including Conspec and Transmitton, an order was placed in December, 1980 with the latter company.

Following the successful completion of the No. 26 project in May, 1982, management's attention was focused on acquiring a system for Lingan, drawing on the experience gained earlier. At the suggestion of Canmet, Conspec was again included in a review of available systems. After much discussion it was decided that, with several changes, Conspec could meet the specifications and offered the unique opportunity to test a Canadian built system. Accordingly, in September of 1983 the purchase order for the Lingan System was issued to Conspec. Substantial completion of the Lingan project was attained in June, 1984. However it was not until around April of 1986 that monitoring of the first pumping station was successfully commissioned.

After completing the basic system installation at Lingan, CBDC further expanded the application of remote environmental monitoring at it's other sites. In the Fall of 1986, a Transmitton System was purchased and installed at Prince and recently another Transmitton System was purchased for Phalen. In addition to environmental monitoring, the Phalen System will have the capability to monitor and control the coal clearance process. Similar expansion of the Lingan capability is planned.

## 1.3 Scope of Study

One of the major reasons for selecting Conspec as the supplier of the Lingan Monitoring System was the opportunity to compare a Canadian built system, with the previously installed Transmitton System at No. 26. Toward that end, Canmet awarded a contract to CBDC to study the Conspec System over a period of 12 months and submit a formal report outlining their operational experience. More specifically the scope included:

- Describe the Conspec System in detail, including the installation activities.
- Briefly describe the No. 26 Transmitton System and generally compare it with Conspec.
- Record and Summarize performance of the Conspec System.
- Describe any deficiencies with the Conspec System, particularly those where further R & D could improve it's performance.
- Install sensors in an operating longwall district, compare their performance against actual mine conditions, and record data in such a way as to allow ventilation studies at a later date.
- Prepare a final report summarizing the above within 60 days of completing the project.

# CHAPTER 2.0 DESCRIPTION OF CONSPEC SYSTEM AT LINGAN MINE

## 2.1 General Description

**Figure 1** is a schematic general layout of the present Lingan remote monitoring system. Environmental and mechanical/electrical conditions are sensed by electro-mechanical transducers located throughout the mine. The output of these transducers is converted to a digital signal and transmitted to the central monitoring station located on surface where a computer continuously monitors the conditions.

Three basic type of transducers are employed:

- Analog transducers continuously monitor variable conditions such as ventilation air velocity, %CH4, and motor current.
- Binary transducers sense 1 of 2 possible states such as motor contacts open or closed, vibration normal or alarm, or doors open or closed.
- Commandable binary transducers enable a remote signal to open or close a set of contacts such as for start/stop motor controls.

The transducers are grouped together at several remote outstations. The functions of an outstation are:

- to provide a central remote location where a group of transducers can be monitored and controlled.
- to provide power for the transducers in the area.
- to provide a degree of local logic and control

circuitry including status displays, local alarms, and start/stop functions which can operate independently of the central monitoring station.

- to prepare the data signal for long distance transmission to surface.

At present there are 2 outstations on surface serving the main ventilation fan, and the CH4 extraction plant. Underground there is an outstation at each of the 3 operating longwalls plus a special outstation on 9 East longwall to accommodate the special monitoring equipment installed for this research project. There is also an outstation at each of 3 underground water discharge pumping stations.

The outstations are further grouped together on main trunk lines which carry the signals to the central monitoring station. These data transmission trunk lines can be half duplex whereby transmit and receive signals are sent sequentially on a single pair of wires, or full duplex with simultaneous transmit and receive signals on separate pairs of wires. At Lingan we presently have 4 trunk lines organized as follows:

| Trunk | Data | Outstation |
|---|---|---|
| 1 | H.DX | 9 East, 10 East, 6 West walls |
| 2 | H.DX | 9 East Wall (Canmet) |
| 3 | F.DX. | 3 East, 4 x-cut, 6 Drive Pumping Stations |
| 4 | F.DX. | CH4 Plant, Main Fan |

Trunk No. 2 is presently about 9.4 km. long. The original system specification required the capability of transmitting data in digital format over a distance up to 12 km. Due to the length of transmission lines, it was necessary to use modems at each outstation and on each trunk at the central monitoring station to condition the signal amplitude.

To protect the computer and the underground system from dangerous voltage spikes, special line and portal protectors are incorporated in the main trunk lines.

## 2.2 Detailed Description

### 2.2.1 Central Monitoring Station

Figure 2 is a schematic layout of the central monitoring station which consists of a monitoring computer, a graphics/data summary computer, and various input/output devices. This station is located in the mine administration building in the same room as the mine communications center. With the monitoring system now monitoring key functions such as the main fan, methane extraction plant, pumping stations, and wall ventilation, it has been necessary to have an operator in full-time attendance. The operator also runs the mine communications console.

All the equipment in the central monitoring station is powered by an un-interruptable supply which provides regulated AC and DC power, battery backup of up to 4 hours in case of failure of the mains, and auto-switching so as not to disrupt the monitoring system.

The heart of the monitoring system is the Senturion 200 model 3D computer. It has the software necessary to perform all the continuous monitoring and control functions, to control the data transmission system, and to scan the status of all the transducer accessors, and output the data to various input/output devices or transmit it to separate information processors. The Senturion 200 has a total of 64 kilobytes of random access memory.

The Senturion's I/O devices include:

- 1 Televideo 925 monochrome CRT and keyboard control terminal and alarm horn for inputting commands to the Senturion, and displaying the status of selected points.
- 2 Mannesmann Tally MT-180 printers. 1 for alarms and the other as a general report printer. This second printer is shared with the Quay 910 computer.
- 1 8 1/2-inch, single-sided disk drive to load the operating programs for the monitoring system and to copy and re-load the system configuration data (status disk). This disk has a capacity of 256 kilobytes of data.

The Quay 910 computer receives and stores the instantaneous, formatted and corrected data from the Senturion. It runs the graphics and data summary software including trend plots and process layouts (mimics). It has a total of 208 kilobytes of random access memory.

I/O Devices for the Quay 910 include:

- 2 ISC Intercolor color CRT and keyboard terminals. One acts as the control terminal for running the trend or mimics software. The other is connected as one of 4 possible remote terminals. It is interchangeable with the other and can also run the trend or mimics software.
- 1 Printacolor IS 8001 color printer is used to produce copies of the displays on either of the 2 color terminals.
- 1 Mannesman Tally MT-180 printer is shared with the Senturion for general reports.
- 1 8 1/2-inch double-sided disk drive for loading the trend and graphics software and for copying data files. It has a capacity of 1.25 megabytes of data.
- 1 10-megabyte Winchester hard disk drive.

Four separate main trunk lines deliver the digital monitoring signals from the outstations. Each trunk line is served by a Develcon Modem which conditions the signal amplitude for long distance transmission and equalizes the impedance of the communications cable. Each trunk line has line protectors against stray voltage spikes and the underground trunk lines (1,2,3) also have portal protectors.

### 2.2.2 Typical Wall Outstation

**Figure 3** is a schematic layout of a typical wall outstation. The main purpose of an outstation is to centralize the circuitry for data transmission between the local transducers and the central monitoring station on surface. At Lingan mine, 3 outstations of this type are connected in parallel on main trunk No. 1. A modem conditions the signal for transmission along the main trunk.

Each outstation is powered by a regulated intrinsically safe supply which provides battery backup and automatic switching in case of mains failure.

The signals from the transducers must pass through accessors before they are sent on the main trunk. Each transducer has its own accessor card which converts the signal to digital and attaches a unique address so that the computer can identify the signal source. There are 3 basic types of accessors corresponding to the 3 types of transducers.

- Analog accessors convert the signal from analog transducers (eg. J-Tec air velocity monitors, BM1 %CH4 monitors). An accessor may be located at the outstation with a voltage or current signal input from a distant transducer, or at the transducer where the transducer output is converted immediately to digital before transmission along the remote accessor trunk line. Configured in the latter way the uniquely identified signal from many transducers can be transmitted along 1 signal pair thereby reducing the need for cabling.

When the analog accessors are located at the outstation, the analog signal from each transducer can be monitored locally at the outstation by the local alarm station. When pre-selected analog values are noted by the alarm station, it sends a signal to the local relay station which can operate 3 sets of contacts to perform such tasks as turning on an indicator light, tripping a motor, or performing a local start or stop function.Each wall outstation can have up to eight analog accessors.

- Binary accessors are located at the outstation and can serve up to 10 binary inputs such as motor contact status open or closed, vibration switch normal or alarm, or doors open or closed. As with the local alarm cards for the analog transducers, the signals from the binary transducers can be sent to the local relay station to operate up to 3 sets of contacts.

- Remote commandable accessors can receive a signal from the central monitoring station or some other remote location and can perform up to 3 start/stop functions.

Each outstation also has the necessary power supplies to operate the transducers. Each DC-3 power supply converts 120 volt AC to 18 volt DC for 1 Bm1 Monitor and battery back-up, or 1 J-Tec air velocity monitor.

Physically a wall outstation is located in a split of fresh air at the outside end of the material level. It is usually constructed by mounting the equipment on sections of cable tray which is set on a concrete pad.

### 2.2.3 Transducers

**Table 1** list the main transducer types being used at Lingan. All of the points monitored by the computer are summarized in **Table 2**. Their locations in the mine are shown on **Figures 4 - 9**. On each of the producing longwalls the velocity of ventilation air and the % CH4 are monitored at the outside ends of the intake and return levels and inbye and outbye cundies (where applicable). In addition, the velocity and % CH4 of the gas flow in the methane drainage line are monitored continuously. Additional air velocity and % CH4 monitors were installed along the length of the 9 East levels for this research project.

Monitors at the pumping stations include sumpwater level, inlet water flow, discharge water pressure, motor load, bearing temperature, vibration, motor electrical status indicators, and pump control.

The fan outstation includes monitors for air velocity, %CH4, carbon monoxide, fan water gauge, barometric pressure, ambient air temperature, bearing temperature, vibration, and various fan control circuits.

The methane extraction plant monitoring includes inlet and outlet flow quantity, %CH4, suction, discharge pressure, gas temperature, and atmospheric CH4 alarm. The status of the extractor motors and the control circuits are also monitored.

The main types of transducers are described below:

**J-Tec (VA-216B)**

This is a rugged, no-moving parts air speed sensor designed to operate in harsh environments. It operates using the vortex shedding principle. An ultrasonic acoustic signal of known frequency is transmitted. Frequency shifts due to air turbulence caused by a specially designed post located upstream is detected by an adjacent receiver. The difference in frequency, is related to the number of turbulent flow vortices and thereby to flow velocity.

The instrument is mounted in an airway at a convenient location which is not usually the location of the average air velocity. A calibration procedure is used to compensate for this. Due to small eddies in the air flow, the apparent flow quantity sensed by the J-Tec VA-216B is often seen to fluctuate considerably. This may be compensated somewhat by modifying the circuitry to include an appropriate RC time constant. Another option is to include a software routine to provide a moving average of several measurements although this was not possible with the Conspec Software.

The J-Tec VA-216B requires a 35 mA, 10 to 18 V.DC supply and produces a 0.4 to 2.0 V.DC linear signal. For the optional current output of 4 to 20 mA, it requires a 63 mA supply. Its measurement range is 50 to 3000 ft/min, with an accuracy of ± 2% of full scale, when calibrated.

**J-Tec (VF-581-8B)**

This is essentially the same type of instrument as the J-Tec VA-216B, except that rather than for use in open airways, it is designed for insertion into pipe lines. At Lingan Mine the VF-581-8B is used to monitor gas flows in the methane drainage pipelines on the operating longwall panels.

It has a range of 125 to 2100 CFM when placed in an 8-inch pipe and has an accuracy of ± 2% of full scale. Power requirement is 30 MA at 10 to 18 V. D.C. It produces a 0.4 to 2.0 V. DC. linear analog signal. For the current output option of 4 to 20 mA, a supply of 58 mA is required.

**Sieger BM1**

This is a 0% to 3% by volume CH4 monitor composed of 3 separate pieces. The detector head is a small cylindrical assembly which is generally hung near the top of a mine airway. It contains a low power pellistor detector, flashback arrestor, and head amplifier to produce a 0.4 to 2.0 volt DC. linear analog signal.

The signal from the detector head is fed to the control unit where the CH4 concentration is displayed on a meter and/or transmitted to an outstation. The control unit also has 2 alarm relay outputs that may be used to activate alarms or initiate start/stop relays.

The Bat1 battery pack provides 7 AH of backup power sufficient to operate the instrument for several days in the event of mains failure.

**Sieger BM2H**

This is a high concentration (0 to 100%) by volume CH4 monitor which is used to measure the concentration of CH4 in the methane drainage pipelines on each operating longwall panel. It has 4 main parts-detector head, filter unit, control unit, and battery backup.

An orifice plate in the methane drainage pipeline causes a differential pressure to force a small gas flow through tubing to the filter unit. This latter unit serves to remove condensation from the sample before it passes to the detector head.

The detector head utilizes the principle of thermal conductivity. A heating element is cooled by the passage of gas and the resulting temperature is sensed. The rate of which the heat is dissipated is dependent upon the heat capacity of the gas. For mixtures of $CH_4$ in air a 2.0 volt, non-linear signal with 0.4 volt offset zero can be calibrated with an accuracy of ± 3% $CH_4$.

The control unit provides a meter for local display of % $CH_4$ and also transmits the signal to the outstation. It also has 2 independent and adjustable alarm levels and 2 single relays that may be used to initiate alarms or start/stop relays.

The Bat1 battery provides up to 4 days of emergency power in case of mains failure.

### Conspec CO Monitor

The Conspec P1212 Carbon Monoxide diffusion monitor consists of an Ecolyzer C sensing head (model 5001 DGFR) and a Conspec A60 accessor card within a Nema 4 enclosure. The analog accessor sends a digital signal back to the outstation and thereby to the central computer.

The sensing head has a range of 0 to 50 ppm CO with an accuracy of ± 2% of full scale. It produces a 0 to 1 Volt DC analog signal to the accessor card. It is specified for use in environments with 10% to 85% relative humidity and temperatures of 0 to 50 $^{o}$C.

### Chromolox RTD's

These are temperature sensing transducers which operate on the principle of changes in electrical resistance of platinum wire as a function of temperature. They are calibrated to 100 ohms at 0 $^{o}$C and have a range of -34 $^{o}$C to 65 $^{o}$C with an accuracy of ± 0.5 $^{o}$C.

### KDG - 6320 Water Pressure Transmitters

This pressure transmitter is used to measure the discharge pressure of the underground pumps. It has a range of 0 to 500 psi with an accuracy of ± 0.5% of full scale.

## KDG - 8010 Water Level Transmitters

This transducer is used to sense the height of water in the lodgements at the mine water discharge pumping stations. It is completely submersible with a range of 0 to 4 meters at an accuracy of ± 1.5% of full scale. It may be equipped with an indicator for local display.

## Bailey - BQ7 Water Flow Transmitter

These units are used to measure the fresh water flow into the mine as well as the discharge flow of the pumping stations. The differential pressure across an orifice plate is sensed by capacitors mounted on a sensing diaphragm. The differential capacitance is calibrated to a 4 to 20 MA D.C. signal which is proportional to differential pressure. By proper sizing of the orifice plate in an 8-inch pipe line water flow in the range 0 to 2000 gal/min. at an accuracy of ± 0.25% of full scale may be displayed on a local meter or at the central computer.

## Foxboro-E13DM Barometric Pressure Transmitters

The E13DM is actually designed as a differential pressure transmitter, but by sealing one of the pressure ports, it may be calibrated to respond to barometric pressure changes. Pressure changes are detected by a metal diaphragm capsule. As the capsule deforms due to pressure, the movement is translated by electronics to a 4 to 20 MA d.c. linear signal. The instrument range was 98 - 104 kpa (29 - 30.7 in Hg.) Accuracy is ± 0.5% of the span (ie. 0.03 kpa or 0.009 in Hg.)

## Foxboro - 823 DP Water Gauge

The differential pressure across the main ventilation fan is detected by the Foxboro 823 DP differential pressure transmitter. A metallic sensor diaphragm changes shape in proportion to the pressure difference across it, and a 4 - 20 MA D.C. linear signal is produced. The instrument range is 0 - 30 inches of water gauge, with an accuracy of ± 0.2% of the span (ie. 0.06 inches water).

**Trolex - TC10 Bearing Temperature Switch**

This unit mounts directly onto machinery such as water pumps to monitor temperature changes over an adjustable range of 20 °C to 80 °C. A fast-acting metal expansion thermostat operates output contacts as the temperature rises to the set point. The electrical contact is rated at 1 amp, 240 A.C. and is used to activate a trip switch and send a signal (normal or alarm) to the central computer.

**Inertia - 3171 Vibration Protection Switch**

This device mounts directly on machinery such as water pumps to monitor for abnormal vibration at a pre-set level in the range of 1 to 9 g. A metal ball is held up in a conical seat by the attraction of a permanent magnet. When sufficient vibration forces are present, it breaks free of the magnet and drops to activate a microswitch. This switch has a rating of up to 5 amps, 440 volts A.C. It can be used to activate a trip switch and send a signal (normal/alarm) to the central computer.

**Baldwin Francis - NPT1 Power Monitoring Package**

This module mounts in a motor control unit. It provides binary status information including contactor open/closed, earth leakage o.k/alarm, and motor overload ok/alarm and also a 0.4 to 2.0 v.d.c. analog signal of 0 - 300% motor current. Provision to monitor motor voltage and power consumption is also supplied but not utilized at present.

### 2.2.4. Software Capabilities

One of the main reasons for choosing the Conspec Remote Monitoring System was its advertised superior software capabilities. At Lingan Mine, the primary requirements were to continuously monitor conditions underground, to display alarms when pre-set limits were attained, and to display and summarize values for the information of mine management.

#### 2.2.4.1 Senturion 200 Software

Upon initial start-up it is necessary to load the software from floppy disks and to configure the system. This includes the identification of all the I/O devices and the point numbers, accessor numbers, correction factor and offset values, and the values at which to alarm. All of this information is stored on a "status disk" which must be read into the computer again on future start-ups. Subsequent changes to the system are regularly recorded on the status disk.

The Senturion 200 monitors all field equipment through a sequential polling or scanning of every accessor that has been put on line. A list of all the transducers currently being monitored by the computers and their addresses is termed the "Accessor Scan List". Each address to be scanned is queried sequentially by the computer. When operating properly the appropriate accessor activates the remote modem and sends its response. Data transfer is achieved with 2 11-bit words transmitted at 4800 baud. Including the time for switching of the modems, total communication time is about 30 milli-seconds for each address.

At Lingan we presently have about 90 accessors in the scan list on 4 main trunk lines. Since certain addresses are used on several trunks, there are about 77 unique addresses. Total system scan time is therefore about 2.3 seconds.

If a particular accessor ceases to operate, the computer software can detect it and issue an error message. The process may be outlined as follows.

- The computer queries a particular address. If the accessor does not respond on the first try, the computer attempts a second and if necessary, a third try. If after 3 tries, it has not received an intelligible response, the computer proceeds to scan the rest of the points in the system.
- During the second scan (about 2.3 seconds later), the computer again makes up to 3 attempts to get an intelligible response. If none is received, it again completes the rest of the scan.
- Upon the third scan, the computer again queries the problem address. If on the first try it doesn't receive an intelligible response, it concludes there is a communication failure and an appropriate message is printed on the alarm printer.
- If on subsequent scans after only 1 try, this address once again begins to communicate, the computer concludes that communication has been restored and prints an appropriate message on the alarm printer.

Only 8 of the 11 binary bits are actually used for data. The full range of analog transducers must therefore be represented by $2^8$, or 0 to 255 data bits.

A correction factor and offset value may be entered initially for each accessor. This enables the computer to make a linear transformation from bits back to analog values for display on the screen or in various types of reports.

The status of the entire system can be displayed on the control terminal. The screen on the control terminal is divided into 7 areas, each for a particular type of display. An outline of the screen is show on Figure 10.

The main areas to note are as follows:

- Area 1 shows the current date and time that is set initially when the system is started and is maintained automatically by the built-in system clock.
- Area 2 is reserved for display of up to 12 alarm and/or return-to-normal conditions for certain transducers that may be designated as critical. Currently most of the transducers are included in this category.

  In addition to these 12 alarms, the system can store alarms in memory and output them to the screen or to an alarm summary print-out. A memory buffer can simultaneously store up to 128 different alarms. All alarms and /or changes of state and the time of their occurrence are printed automatically as they occur on the alarm printer. In addition, an alarm horn can be programmed to sound for selected points.
- Area 3 is used for entering system commands and for relevant system responses. Table 3 summarizes the commands. To facilitate command entry, a scrolled command menu is shown at the

base of the screen in Area 7.

- Area 4 displays the continuous status of up to 6 pre-selected points simultaneously. Each time the computer scans one of these points and finds a different status, it is printed on the screen.

- Area 5 displays any pre-programmed event sequence which is currently in operation.

- Area 6 displays the binary identity and output of a selected accessor.

Besides the information printed on the screen there are several major printed reports which are available on either one of the 2 system printers. Generally when 2 printers are used, one is designated as the event printer and the other as the data printer.

The main printed reports are:

1. **Event Log:**

   Figure 11 shows a portion of a typical event log. As previously discussed, any change of state including communications failure, communications restored, alarm, or return to normal values are recorded automatically on this log as they occur. For each occurence the report prints the time, Point No., Descriptor, change of state, value at the time, and the units. When events occur faster than the printer can print they are stored in an alarm buffer in memory. Up to 128 events can be stored in this fashion.

2. **All Points Log:**

   Figure 12 is an example of All Points Log. This report gives the status of all the points in the system at the current time. The information shown includes date, time, Point No., Descriptors, status, value and units.

3. **Alarm Summary:**

   **Figure 13** is an example of this report which gives a summary of all current alarms, communication failures and/or return to normal events.

4. **Descriptor List:**

   **Figure 14** is an example of a Descriptor List. This report summaries all the information that must be entered when a new accessor is entered into the system, except for the analogue parameters. The Descriptor List shows all Point Numbers, their Descriptors, and Addresses regardless wether or not they are currently being monitored by the computer and are "in the scan".

5. **Accessor Scan List:**

   **Figure 15** is an example of this type of report, which gives a map of all the points in the system, their address, and trunk. An asterisk indicates those points that are currently being monitored by the computer and are "in the scan". Note that a point in one trunk can have the same address as a point in other trunks.

6. **Analogue Parameters:**

   **Figure 16** is an example of this type of report. It gives each Point No., Descriptor Reference numbers for the offset and correction factors, maximum and minimum accessor bits and resulting analogue values, and the delay to alarm in seconds. The values of the offsets and correction factors are summarized in the correction factor and offset table.

7. **Correction Factor and Offset Table:**

**Figure 17** shows data in this table. Up to 255 different values of correction factors and offsets may be listed, each set having a unique reference number. Any point in the system can utilize a particular set of correction factor and offset by assigning the proper reference number. These values are used to convert the number of data bits transmitted by the remote accessor into engineering units according to the general relationship.

Value = (Correction Factor X No. bits) + Off-set.

For example, if a particular J-Tec air velocity sensor has an output of 1.0 volt, its accessor might produce 155 bits out of a possible 255. By calibrating the output to the actual flow conditions it is possible to solve for the correction factor and offset values that yield the correct flow rate in c.f.m.

8. **Trend Log:**

**Figure 18** is an example of a portion of a Trend Log Report. This software enables a periodic printout of the analog values or point statuses of up to 10 selected points. The interval between updates can be from 1 to 99 minutes. At each update, the instantaneous value at each point is printed. This differs from the Continuous Status Report where the instantaneous value from each scan (about 2.3 seconds apart) is printed to the screen. Trend Log is very useful when it is necessary to record the values from certain transducers over a period of time and when greater accuracy than on the graphical trend plots is desired. At Lingan, it is often used during the re-calibration of instruments.

9. **Shift Report:**

**Figure 19** is an example of a Shift Report. This portion of the software allows up to 5 automatic printouts per day of the average status of up to 30 selected points. The computer averages the instantaneous values taken at 1 minutes intervals during the period since the last automatic print-out. The number of auto-printouts per day can be between 1 and 24. If 1, the average is calculated using 1440, 1 - minute samples. After each auto-printout the software drops the value, from the preceding report and begins to accumulate the averages for the next report. However, between each auto-printout it is possible to request a manual printout of the values of the averages accumulated so far for the auto-printout, without affecting the auto-printout. At Lingan 1 24-hour shift report is produced each day for management.

#### 2.2.4.2 Quay 910 Software

The Quay 910 computer, Winchester hard disk drive, 8 1/2-inch disk drive, 2 color terminals, 1 color printer, and 1 standard printer constitute a color graphics and management subsystem that is an optional addition to the basic Senturion 200 monitoring system described previously. The Senturion 200 monitoring system can operate independently of the Quay 910.

The status of all the points being monitored by the Senturion 200 is continuously copied to the Quay 910. Its software is designed to organize, store, and print the data in 2 main forms - process display outlines, and graphs.

Upon initial start-up of the 910, it is necessary to load the operating software from disk and configure the output formats required. This latter configuration is very cumbersome and time consuming but can be saved on disk for ease of entry on subsequent start-ups.

The major software outputs of the Quay 910 are summarized below:

1. **Colored Process Display Outlines:**

   Figure 20 is an example of this type of display. Any grouping of transducers or outlines of processes such as the ventilation of a longwall can be stored in the computer. Later, by calling up that particular configuration, the current values from all the transducers in the outline can be viewed simultaneously. It is also possible to signify alarms on the screen by flashing values. The color graphics system has a very large capacity, providing up to 256 active pictorial displays. Up to 32 analog or binary points can be assigned to each display. The information from these points can be dynamically updated. It is also possible to copy the screen display on the color printer.

2. **Graphs or Trend Plots:**

   Figure 21 is an example of an analog vs. time Trend Plot. Analog vs. analog plots are also possible. Up to 30 different plots can be configured for later output. For the analog vs. time plots, the time interval, and the maximum and minimum vertical ranges of the plot can be selected. The computer automatically averages and scales the data for output to the screen. Once a particular plot is requested the values are set. They will not update dynamically, however current values will be displayed with each subsequent request. These plots can also be routed to the color printer should a hard copy be necessary.

3. **Alarm Instruction Phrases:**

   User defined messages can be automatically displayed or printed after certain selectable events in the monitoring system have occurred.

4. **Preventative Maintenance Work Orders:**

   A maintenance work schedule for selected equipment can be automatically printed when certain pre-set conditions are met.

5. **Equipment Stoppage Analysis:**

   A statistical evaluation of stoppages of selected monitoring equipment can be generated by sampling the status of the relevant transducers.

## 2.3 Installation Activities

Table 4 outlines the milestones in the installation of the Lingan remote monitoring system. After the No. 26 Transmitton system was substantially completed and in operation around January, 1982, attention was focused on the Lingan requirement.

Subsequent to the review, and later the decision, not to buy the Conspec System for No. 26, about 18 months earlier, considerable changes had been made to their system. Also, Canmet recommended that they again be considered for Lingan. The opportunity to try a different system, to compare it with the Transmitton

System, and to utilize a Canadian made product were stressed.

In June of 1982 the specifications for the Lingan System were complete and tenders were sent out in September. When tenders closed in November, it was found that the Conspec proposal was incomplete and did not address all of the original specifications. After several meetings, discussions and visits to the manufacturer and the USBM who had assisted with the system development, the following deficiencies were still apparent.

1. None of the central monitoring equipment was CSA approved.
2. The 2 accessor cards did not have EMR certification numbers and the data transmission link was not considered intrinsically safe.
3. Only standard high/low alarms were user configurable. Other alarms required programming on the event sequencing software package.
4. Only 30 pre-selected points could be graphed .
5. It was not capable of adjusting for non-linear outputs.
6. Exposing hazardous voltages underground during periodic maintenance was required.
7. Quite a bit of system programming was needed to configure the system upon start-up.
8. The system had not yet been tried and proven in underground coal mines.

The original analysis recommended against purchasing the Conspec System, however after discussing these problems with Conspec, it was decided that they could be overcome. On this assurance C.B.D.C. awarded the contract to Conspec. The purchase order was received by Conspec in September of 1983 and delivery was set for January 25, 1984.

Delivery of the Conspec equipment did not actually take place until April of 1984 about 3 months later, causing CBDC to invoke a penalty clause in the contract. Delays were also experienced with the DC3 power supplies for the transducers and construction and equipping of the wall outstations, both of which were completed in June. Commissioning of the Central Monitoring Station and 5 outstations was carried out in June, 1984, 2 months behind the original schedule. Despite this, serious problems still existed that prevented the complete system operation. These included:

1. With each installation and any subsequent changes it was necessary to balance the system impedance at each modem. This was accomplished through a trial and error method since there were no capabilities to completely analyze it underground. This was a very difficult and time consuming procedure which was compounded further by unfamiliarity with the system and breakdown of other components.
2. The Televideo terminal for the Senturion 200 did not work properly. It was returned to

Conspec on July, 1984 and it was recommended that a constant voltage transformer be installed. The terminal was not returned until October 16. The problem again recurred on November 6. While the Televideo terminal was away, in order to use the Senturion, it was necessary to modify the system so that it could be operated from the ISC terminal. Since the system was not originally designed to operate in this manner, many difficulties were encountered. Later, the ISC terminal failed. It was returned to Conspec in Oct/84. Initially Conspec did not recognize a problem with it, however, finally repairs were made to a broken transformer connection and the unit was returned to CBDC in Feb/85.

3. The un-interruptable power supply (UPS) did not function properly and was returned to Conspec in Sept./84. The original problem was screen shrinkage on the system terminal during power failures and it was not switching fast enough to save the system program. Conspec reported that tightening of the circuit boards was the solution. Further modifications made it operational, however, the automatic switching function during power failures still is questionable and does not operate consistently.

4. Great difficulty was experienced in getting the Quay 910 graphics processor to work properly. A new disk containing a revised operating program was to be sent in September/84, however it was the same disk as previously being used. Later in February/85, Conspec concluded that the 910 Processor could be defective and suggested it be returned for testing.

5. The system clocks in both processors were judged to be inaccurate. The Quay 910 clock was fast by about 20 minutes each day. As a result the system had to be re-set every day in order to obtain accurate timing on the graphics data.

6. Calibration constants for transducer data did not seem to be passed over to the Quay 910. As a result, the values displayed on the graphics system were often wrong.

7. The event sequencing software required a procedure and sample program to generate descriptors and alarms for special events.
8. Binary alarms did not operate properly on the Quay 910. When alarms occurred, the screen did not dynamically update.
9. Eight days of on-site training by Conspec had been scheduled for June/84, however, it was found necessary to spend 5 1/2 days on system start-up and only 2 1/2 days were actually used for training.

As a result of these problems, CBDC staff were forced to do development work to make the system operate properly. Although some environmental monitoring was possible in June/84, full operation was not achieved until about April/86, when the first pumping station transducers began operating. The delay in commissioning was about 2 years.

## 2.4 Maintenance and Operational Procedures

In order to keep the monitoring system performing properly, a regular system of preventive maintenance and calibration is necessary. The following is a summary of the required maintenance procedures for major components at Lingan Mine.

- **J-Tec Air Velocity Sensors (216B)**

  Checks for physical damage to the instrument and wiring and cleaning of the sensing head is done daily. On a frequency of once per month, the accuracy of the instrument is checked by comparison of the actual air flow in the mine to the computer output. If a significant discrepancy is discovered, a recalibration procedure is initiated. This is usually a complicated procedure involving an electrician and a ventilation officer underground and one of the remote monitoring staff to make computer changes in the Central Monitoring Station.

- **BM1 Methane Monitors**

Checks for physical damage to the instrument and cabling and cleaning of the detector head is done daily. On a weekly basis the detector heads of instruments inside cundies are replaced and the old ones are sent to the shop for recalibration. Also, weekly, the high level (2.0%) alarm is tested, and the instrument readings are checked with the local reading and the display on the computer. For other BM1's in a less dusty location, the detector heads are changed monthly. All other BM1 control units are also changed monthly.

- **J-Tec Pipe Flow Sensor (VF581-8B)**

Weekly checks are made for damage to the transducer, cabling, and couplings. On a monthly basis, flows as recorded by the methane supervisor and compared to the transducer output. Changes are made as necessary.

- **BM2H**

The hoses and connections are examined daily. Weekly, the alarm settings are tested and the readings recorded. Once a month the detector head is changed.

- **Wall Outstation**

The wall outstations are examined daily to ensure that the enclosures are clean and not damaged and that all the other equipment, cables, and connectors mounted on the outstation panel are in good condition. Once a month the enclosures are also opened and examined, the battery backup is tested, and the outstation is reset.

- **Fan Outstation**

  The Fan outstation is examined daily for any damage to the outstation enclosure, other panel equipment, cabling, and connectors. Once a month the internal wiring of the outstation enclosure is also checked. The battery backup is tested and the outstation reset once a month.

# CHAPTER 3.0 COMPARISON OF CONSPEC AND TRANSMITTON SYSTEMS

## 3.1 Transmitton System at No. 26

### 3.1.1 General Layout

Figure 22 is a schematic layout of the No. 26 Transmitton Remote Monitoring System as it existed before a fire necessitated the sealing of the mine in April/84. Signals from the transducers were transmitted to the 6 main outstations located throughout the mine and on surface. The outstations contained circuitry to enable local display of transducer status, local control of equipment, local alarm settings, and the multiplexing and digitizing of the data for transmission to the central monitoring station, on surface.

Signals to surface were transmitted in full duplex mode at 600 Baud via a 7-pair cable. The signal pairs were organized as follows:

- 2 pairs were designated as Ring/Trunk B, serving the Main Fan Outstation, Main Booster Fan Outstation, 9 South Booster fan Outstation, and 10 North Booster Fan Outstation.
- 2 pairs were designated as Ring/Trunk A, serving 13 South Wall Outstation and 13 North Wall Outstation.
- 1 pair was utilized for voice communications between the Central Monitoring Station and all of the outstations.
- 2 pairs were spare.

The furthest Outstation was about 8 kilometers from the central monitoring station.

### 3.1.2 Central Monitoring Station

**Figure 23** is a schematic layout of the NO. 26 Central Monitoring Station. The heart of the system was the Front End Driver (F.E.D.). It had the necessary computer cards to monitor all the data from up to 28 outstations (224 analog and 252 binary inputs) and to transform data to/from the Fall Back Panel and/or the Primary Computer. Up to 8 F.E.D's could be accommodated in the system. At No. 26 Mine, only 1 F.E.D. was installed. As such, the F.E.D., and Fall Back Panel constituted the basic monitoring system which could function independently of the Primary Computer. Each F.E.D. could be configured with 2 Ring/Trunks having 14 outstations each.

The Fall Back Panel was the primary input/output device for the F.E.D. It had the capability to display the status of the entire system on one annunciator type display panel and to display the values of selected points on either of 2 chart recorders and 1 meter. It also had the capability to perform system diagnostics.

To extend the capability of the monitoring system beyond that which is capable with the F.E.D. and Fall Back Panel alone, a Primary Computer was included. This computer received the signals from the F.E.D. and organized it into selected report formats that could much more easily display the present status of all transducers and historic data. Up to 60 graphs of analogue data could be displayed over selected periods of 8 hours, 24 hours, or 7 days. For each graph the computer used 72 values averaged over time intervals of approximately 7 minutes, 20 minutes, and 140 minutes respectively. Storage of data beyond 7 days was possible on paper tape, however if not recorded every 7 days, the data was lost.

The Primary Computer also had the ability to transmit commands to selected points. Once installed, the Primary Computer monitored the system via the F.E.D. In the event of a problem with the Primary Computer or for any other reason, the system could be monitored independently by the F.E.D. and the Fall Back Panel. The Primary Computer had 16 k PROM and a total of 64 k of RAM. It's I/O devices included:

- 1 Control keyboard and color monitor for inputting commands to the system and displaying the various report outputs.
- 1 Texas Instrument Silent 700, Model 745 printer and auxiliary keyboard. This printer

was used to obtain printed copies of the data reports. The keyboard and printer could be used as an alternative Control Terminal if there was a problem with the main terminal.

- 1 GNT Automatic, Model 27 paper tape reader for inputting the control program, system configuration, or historic monitoring data.
- 1 Facit 4070 paper tape punch for making copies of control programs and system configurations, and to store monitoring data for future use.

The F.E.D. and Primary Computer were powered with 240 V.A.C. to 5 V.D.C. power supplies. In addition, the Primary Computer had an emergency battery power supply for up to 2 hours of operation in case of power failure. This was necessary in order to protect the volatile program and data, stored in the RAM.

### 3.1.3 Outstations and Transducers

The types of transducers used were nearly identical to those in Lingan except water flow was not monitored. The basic types of transducers used at No. 26 are shown in **Table 5**.

**Table 6** shows the distribution of transducers by outstation. Each outstation had the capability of handling 8 analog and 9 binary inputs. In addition, up to 4 of the analog channels could also transmit a flashing contact status from Sieger type transducers and all 8 were also monitored by comparators to give rising or falling alarms, and fail signals.

Data from each outstation on a given Trunk/Ring was transmitted sequentially at 600 Baud. For each outstation about 52 mSec. was used to transmit 31 bits of information. There was also about a 12 mSec. delay between outstations. The time for 1 scan of one F.E.D. configured with 14 outstations per Trunk was therefore about 0.9 seconds.

The status of all binary inputs was transmitted with each scan, however the 8 analog inputs were multiplexed together and transmitted sequentially. Data from the analog transducers was recorded only after 3 successive good scans of each. To complete the full scan of 8 analog transducers therefore took about 22 seconds.

Loss of transmission was indicated after 3 successive faulty scans. An outstation was considered to be in transmission after 3 successive good scans. Data acquired during an occasional bad scan was ignored.

### 3.1.4 Software Capabilities

The Primary Computer software was designed to automatically note any change of status in a transducer, an outstation, or an F.E.D. It was set to raise audible and visible alarms, to display current status, and to accumulate and display graphs and tables describing the past performance of selected points.

In addition, several operator system commands were possible including:

- "Hold-on-Stop" prevented any starting of a plant component.
- "Stop" stopped a plant component and prevented any local (underground) start.
- "Start" removed any previous "stop" command to allow a local (underground) start if no "Hold-on Stop" had been issued.

Alarms were raised whenever a binary alarm channel changed state or whenever an analog value exceeded it's high alarm value, fell below it's low alarm value, or changed it's value at a rate greater than it's pre-set alarm rate. When an alarm occurred, an audible alarm was sounded and an error message was displayed on the bottom line of the screen. Each alarm had to be acknowledged by the Operator by depressing the space bar before the audible alarm was silenced. Only the most recent alarm remained on the screen. Up to 100 of the most recent alarms could be displayed at the Operator's request.

Figure 24 shows the layout of the monitor screen. 7 areas are shown, including:

1. Current date and time, updated every minute.
2. F.E.D. Fall Back Indicator, showed which F.E.D., if any, is not in communication with the Primary Computer.
3. Command Echo and system responses.
4. Alarm messages including time, outstation, digital channel or analog multiplex level, and the current status.
5. Permanent analog display of 1 selected analog report.
6. "Start Failed" message if a "start" command from the Primary Processor had not been effective. An error reason was appended.
7. Various lists or graphs as requested by the operator.

The major lists and graphs that could be displayed on the screen and/or the printer are summarized in Figure 25. These are further described below. The examples shown are not for No. 26, since this mine is no longer in operation and sample outputs could not be obtained, but are from the operation manual supplied by the manufacturer.

1. "List Outstation" gave a list of the outstations defined on the system (e.g. Figure 26).

2. "List Alarms" gave a list of up to 100 current alarms for either all outstation kinds or for a particular type of outstation: Figure 27 is an example of the latter kind.

3. "List Log of Alarms" gave a list of up to 100 or the most recent alarms (e.g. Figure 28).

4. "List Outstation Kind" gave a list of all outstations defined in the system to be of a particular type such as a fan outstation or a wall outstation (e.g. Figure 29).

5. "List Outstation Status" gave the complete current status of a particular outstation including the current value of each transducer (e.g. Figure 30).

6. "List Graph" produces a graphical display of the values from an analog transducer over a selected time period of up to 7 days. The vertical scale is in time, showing the most recent time period. The horizontal axis is in % of full scale, with the full scale and units of the particular point also given (e.g. Figure 31).

7. "List Analog Selected for Graphs" gave those analog transducers which could be graphed, and the time period over which the data from these transducers would be averaged to obtain the 72 data points (e.g. Figure 32).

8. "List Transducer Types" gave a list of all the analog transducers, the full scale and units, the alarm type, and an offset value below which it was deemed to have failed, for each (e.g. Figure 33).

9. "List Analog" produced a list by outstation of all the analog transducers along with the full scale output, low and high alarm settings, and whether or not an instrument fail option had been included (e.g. Figure 34).

10. "List Status of Transducers of a Type" produced a list of the current status of all analog transducers of a particular type such as BM1's, or J-Tec's. It included the outstation, transducer name, full scale value, present output at the time of entering the command, present alarm status, and whether or

not it is currently in transmission.

11. "List Status of Transducers of a Group" produced a list of up to 8 analog transducers that were previously defined as belonging to a certain group such as a particular outstation, overall ventilation, or overall methane drainage. The status information given is similar to that for "transducers of a type" except that in this list the analog values were updated continuously while it is on display (e.g. Figure 35).
12. "List Defined Analog Groups" produced a list of all the analogs that were previously defined as belonging to a particular group. It gave the outstation name, analog name, and group number for each such analog (e.g. Figure 36).

### 3.1.5 Installation Activities

An outline of the major installation activities is given in Table 7. The idea to install a remote monitoring system was first discussed in detail at CBDC around the end of 1978. Since, this was the first such installation at CBDC, the various types of systems available throughout the world were first reviewed and the detailed requirements for No. 26 were laid out. Detailed specifications were completed in April of 1980. Quotations were received from 5 separate suppliers and Transmitton was chosen.

The purchase order to Transmitton was issued in December, 1980. Despite a strike which stopped installation activities for about 2 1/2 months, the system was completely installed and operational in December, 1981 (12 months later).

Early problems were experienced with voltage regulators in the power supplies for the surface computers. As a result, final commissioning by the supplier was delayed until suitable replacement equipment could be obtained. In May of 1982, Transmitton installed the necessary equipment and completed the commissioning.

### 3.2 Comparison of No. 26 and Lingan Systems

Table 8 summarizes a comparison between the Lingan-Conspec system and the No. 26-Transmitton system. The main points to note are:

1. The Transmitton system had a Fall Back Panel that could be used if there were a problem with the Primary Computer. The Conspec System did not have this feature, but could be equipped with a backup computer if desired.
2. The Conspec graphics system has significant more capacity than the Transmitton System. The Conspec Quay 910 graphics computer has 208 k RAM, a 10 Meg hard disk, and a 1.25 meg floppy. This is in addition to the 64 k RAM in the Senturion 200. The entire Transmitton System had a total of only 72 k RAM. The graphics software options on the Conspec System surpass those for Transmitton, yet, several of the Conspec Software options do not work, as further development on them is required. All of Transmitton's Software options worked well.
3. The Conspec system includes several more terminals and printers.

4. The Transmitton communications system is slower than Conspec's but does not require MODEMS. For the Conspec System when multiple MODEMS are used on a given Trunk, initially it is very difficult to balance the system impedances.

5. Overall, major problems in delivery, commissioning, and reliability were experienced with the Conspec System. The major reason for these problems may be due to the fact that the system was not designed for use in underground coal mines and developments to adapt to the demanding conditions are not completed.

## 3.3 Transmitton system at Prince

### 3.3.1 General layout

In September, 1986 a Transmitton Remote Monitoring System was commissioned at Prince Mine. It was chosen based on a review of the best available systems at the time and the experience gained from the No. 26 and Lingan projects.

**Figure** 37 is a schematic layout of the Prince system. Presently there is one outstation on surface serving the main electrical substation, water tank level, fire suppression system, and ambient atmospheric conditions. The underground outstations are protected by an intrinsically safe barrier in the trunk line. The outstations are:

- Surface Fan Outstation:
  - air velocity
  - % $CH_4$
  - CO
  - Fan motor current

- Fan water gauge
- Fresh water flow rate
- Compressor current
- Compressor pressure
- Compressor temperature
- Fan bearing Temperature
- Fan bearing vibration
- Smoke
- Compressor temperature
- Compressor No. 1 status
- Compressor No. 2 status
- Compressor No. 3 status

- East Wall Outstation (2 Walls):
  - Wall 1 intake air velocity
  - Wall 1 intake % CH4
  - Wall 1 intake CO
  - Wall 1 return air velocity
  - Wall 1 return % CH4
  - Wall 1 return CO
  - Wall 2 intake air velocity
  - Wall 2 intake % CH4
  - Wall 2 intake CO
  - Wall 2 return air velocity
  - Wall 2 return % CH4
  - Wall 2 return CO

- West Wall Outstation:
  - Intake air velocity
  - Intake % CH4
  - Intake CO
  - Return air velocity
  - Return % CH4
  - Return CO

There is also provision for a future outstation at an underground main pumping station.

Each outstation provides the interface between the central station and the external transducers. It has the following capacities:

- 32 digital inputs
- 14 analog inputs
- LCD display of outstation status on the door.
- The configuration of input/output functions, alarm set points, and displays may be changed by installing a new EPROM card.
- Regulated 8.5 v.D.C. power supply battery backup
- serial link to the main trunk/ring (600 Baud, Full Duplex)

The main trunk line consists of 1 pair in a single multi-pair cable. Presently all outstations transmit and receive on the same signal pair. A separate pair in the same cable is used for voice communications between the outstations and the central monitoring station on surface.

### 3.3.2 Central Monitoring Station

Figure 38 is a schematic layout of the central monitoring station. It consists of 2 identical computers each having it's own front end driver. One computer and front end driver (F.E.D.) is used as the primary system. The other provides 100% backup in case of failure and may also be used to output information stored on magnetic tape or to make changes to the system configuration without affecting the normal operation.

Each F.E.D. has the capacity to support 2-600 Baud Full duplex trunk lines/rings. Each ring has capacity for up to 14 outstations. At present only 1 ring is used to connect 4 outstations.

The primary computer has the necessary software to allow the display and storage of monitoring data and the use of control functions. Descriptive information about the monitoring system, such as the names and types of transducers and the types of displays required, initially must be entered manually. Thereafter it is stored in non-volatile RAM, having battery backup, and also on magnetic tape. The computer hardware is based on the INTEL 8085 processor.

Input/output devices for each computer include a control CRT terminal and a magnetic tape cassette drive. One printer is provided which is normally connected to the primary computer, but may be easily switched to the standby computer. If required, up to 4 additional independant remote CRT units can be connected to each competer.

An un-interruptable power supply provides regulated power and battery backup for a minimum of 3 hours.

### 3.3.3 Installation Activities

The Transmitton monitoring equipment was ordered in

October, 1985, received, installed, and commissioned on schedule, in October, 1986. It has performed continuously without any major problems to the date of this report (September, 1987).

# CHAPTER 4.0 SYSTEM PERFORMANCE

## 4.1 Transducer Performance

### 4.1.1. Assessment Method

In order to assess the accuracy and reliability of the system transducers, it was decided to perform an amended form of time study. The classical time study method normally requires that samples be taken at random intervals. However, for this study this was not practical since access to the transducers was not possible at random times such as 2 a.m., Saturday, etc. To overcome this problem it was agreed that scheduled inspections of the transducers would be acceptable. Accordingly, throughout the project, regular inspections were made during day shift only. Since extra transducers had been installed on the 9 East Panel for more detailed ventilation research, more emphasis was placed on inspecting these transducers.

For each inspection, actual physical measurements were made by the technologist at the sensor. These were compared with the local reading, if any, at the transducer (e.g. BM1, BM2H control units). Simultaneously, the value displayed on the surface computer was recorded at pre-set 1 minute intervals on the Trend Log report. Alternatively, if Trend Log was not available, and if there were communications, the immediate status output was obtained from the Computer Operator.

Due to the frequent variability of the displayed values from certain transducers, a single value from the Trend Log was not considered appropriate and an average of several readings spanning the time of the actual measurement, was calculated. For J-Tec airflow monitors, which generally had a high variability, 10 readings were averaged. For all other analog, ventilation-related transducers, 5 readings were averaged.

Besides the mean, the standard deviation and 95% confidence level in the mean were also calculated and recorded in the attached appendices. The 95% C.L. was calculated assuming a "t" distribution using the formula:

$$95\%\ \text{C.L.} = \pm S \frac{T}{N^{0.5}}$$

Where: S = Standard deviation
T = Area under the t distribution curve for C.L. 95%, and n = N-1
N = Number of samples

The maximum error of the mean of displayed values at 95% confidence was calculated as follows:

Max. error at 95% confidence = (Mean Displayed value ± 95% confidence level) - measured value

### 4.1.2 J-Tec Airflow Monitors

Output of the J-Tec airflow monitors was verified by actual airflow measurements in the mine at each sensor location. Two measurement techniques were used. The first has been the standard CBDC practice in the past. It consists of determining the average velocity by traversing the entire cross-sectional area of the airway over a 60-second period, using a hand-held, vane-type anemometer. The measurement is repeated and if the second velocity is within 10% of the first, the average of the two is taken as the true velocity. However, if they differ by more than 10%, 2 additional measurements are made. If 3 of 4 measurements differ by less than 10%, their average is taken as the true velocity. Average true velocity multiplied by the cross-sectional area equals the average quantity (in CFM) which may then be compared with the conspec output.

An alternate airflow measurement method was recommended by Canmet after a study of various techniques. This method was basically the same as that above except that the anemometer is mounted on an extension handle and the technologist stands about 1 meter downstream of the cross section. Thus the technologist is not standing in the measurement plane thereby decreasing the cross-sectional area and causing turbulence. Tracer gas studies by Canmet showed that results from this method were more accurate than the standard CBDC method. Results from the "hand-held" method are about 29% higher than from the "extension-handle" method.

Because CBDC had not adopted the extension handle method of measurement and in order to remain consistent with measurements taken by the mine ventilation staff, all measurements of instruments not specifically installed for this study were by the hand-held method. Only at those J-Tec instruments installed for the detailed 9 East study was the extension handle used.

The anemometers used in this study were calibrated regularly utilizing the Airflow Developments Ltd. open jet wind tunnel at Canmet's Research Lab in Sydney. The anemometer was mounted at the wind tunnel discharge as specified by the manufacturer. Using specific orifice plates and the variable speed fan, known velocities in the range 200 to 1500 ft/min were created and checked against the anemometer response. The acquired data was used to make a correction table which was used by the ventilation technologist when measuring air velocities in the mine.

Cross-sectional area was determined by measuring the dimensions with a tape measure. Due to the irregular shape of most airways, a more accurate method was employed to verify these measurements. The cross-sectional area was photographed with a meter stick included for scaling. Later the photo was digitized and the area integrated by computer. Area measurements by this technique were conducted twice during the study. It was found that most areas did not change significantly. Results from the simple tape measurement technique closely matched those from the photographic technique.

**Appendix 1** summarizes the performance of 15 J-Tec airflow sensors. A total of 371 inspections were made. Overall the J-Tec sensors were judged to be available (i.e. transmitting data) 89% of the time. Weighted average maximum error of the mean output (at 95% C.L.) for all instruments was about 3400 cfm greater than the measured value (average 58,000 cfm). However 1 instrument (Point 045 - 6 West Top Level Airflow) had abnormally high output compared to the measured values. This condition persisted throughout the study despite repeated efforts by the technical staff to correct it. The average maximum error of the mean output from 26 inspections of Point 045 was about 35,000 cfm greater than the measured value (average = 61,000 cfm). Ignoring this instrument, the average error for the remaining 14 instruments would be about 700 cfm on an average of about 57,000 cfm.

This indicates that overall the J-Tec's performed rather well. However the availability of specific instruments varied from 0% to 100% and the average maximum error of the mean output varied from 10,000 cfm less than the measured value to 14,000 cfm greater than the measured value (excluding point 045).

The J-Tec transducer was very sensitive to very small changes in airflow. Normal air turbulence caused a high variability of the instantaneous output which did not reflect the true average flow. This is reflected in the high standard deviation of the readings reported in Appendix 1. Standard deviation as high as 26,000 cfm for an average airflow of 65,000 cfm was calculated in one instance (Point 045, May 19, 1987). Excluding Point 045, which may not have been representative, the average weighted standard deviation was about 3900 cfm with an average weighted mean output of 58,000 cfm.

Several other problems were also noted during the study. These included:

1. To test that changes in airflow did cause appropriate changes in the output, a procedure was devised to block the flow through the transducer. On several occasions certain instruments did not

respond properly either not dropping to zero, keeping the same output, or even showing an increased output when blocked. This behavior could be very misleading. On one occasion when the main surface fan was turned off for repairs, the J Tec located about 500 meters in bye on the 9 East material level (Point 356) actually showed an increased output from about 23,000 cfm to about 150,000 cfm. Similarly, Point 046 (6 West Bottom Level Airflow) gave consistent output of about 60,000 cfm, but when blocked the output did not change.

2. Calibration of the J-Tec output on the surface computer to actual measured ventilation flow is a difficult and time consuming procedure. Three persons are required. A ventilation technologist measures the average flow quantity and the velocity of the transducer. From this data, a correction factor and offset value are calculated and entered into the computer by a technician on the surface. If the computer output still does not match the measured flow, another technician at the J-Tec must open the instrument and adjust the span control until the computer output is correct.

3. On one occasion Point 361 (9 East Bottom Level airflow - about 1500 meters inbye) did not respond to blocking or span adjustment. This may have been caused by an open signal line that picked up induced currents, thereby producing a false signal.

4. Occasionally an instrument was located near a ventilation door, or in the vicinity of piled material. This caused temporary velocity changes at the J-Tec which were misleading. If care is taken to locate J-Tec's in a uniformly shaped airway away from obstacles, this would not be a problem.

5. When the 9 East Wall began using the cundy ventilation system, the airflow passing Point 075 (9 East Top Level Airflow) was approximately 20,000 cfm. Due to the large cross-sectional area of the airway at Point 075 (145 $ft^2$) The velocity was very low (about 135 ft/min.). At this condition variations due to turbulence were very large in comparison to the average flow (standard deviation about 7000 cfm). In addition, physical airflow measurements at this low velocity were difficult using a vane anemometer.

### 4.1.3 BM1 Methane Monitors

Output from the BM1 methane monitors was verified by comparing the measured concentration, determined with a M.S.A. model D-6 hand-held methanometer, and the value displayed on the control unit meter, to the conspec computer output. The Conspec output was either an average of 5 values taken at 1 minute intervals from the Trend Log report, or the immediate status value obtained from the computer operator.

The M.S.A. D6 methanometer was calibrated regularly during the study utilizing standard gases of known concentration (1.9% - 2.1%). During this procedure any defective parts were replaced. Also when required the battery was replaced. The zero point was checked and adjusted if necessary and the standard gas was passed over the sensing lead at a rate of 5 c.c./sec. The instrument response was adjusted to the standard gas concentration using the calibration screw.

Appendices 2 and 3 summarize the performance of 18 BM1 methane monitors by Trend Log and 13 BM1's by Immediate Status. In both cases the overall performance was excellent. Overall availability was between 96 and 98%. The average weighted maximum error of the mean output from the Trend Log compared with the actual measured (D6) value was 0.00047% CH4. This is excellent, considering the manufacturers' stated accuracy of both the BM1 and D6 is ± 0.1% CH4.

During the study a few rare problems were noted. These included:

1. If the power supply to a BM1 was suddenly interrupted, it's voltage output could drop very rapidly to zero. This voltage drop might occur before it is noted by a computer scan. At very low voltage (about 0.04 volts) the output from the accessor cards was noted to jump abruptly to about 140 bits. Thus the computer could display a high methane reading (about 1.3%). This is really a problem with the accessor card, not the BM1. It could be very misleading and should be corrected.
2. From November 7 to November 21, 1986 Point 203 (8 East Top Level CH4) was reporting 0.9408% CH4 continuously. During this period an inspection revealed that the value displayed on the control unit was 0.85% CH4. This was reasonably close to the D6 value (0.9%CH4). The problem was later discovered to be that the computer did not have a valid address for this point. During a re-boot of the system it is likely that an old status disk with incorrect information had been used, however the computer held onto the last valid reading. This was not a problem with the BM1 but rather an error by the operating personnel and the software.

#### 4.1.4 J-Tec Gas Flow Monitors

Output of the J-Tec gas flow monitors was compared with the total measured flow from each methane drainage borehole reported weekly by the methane drainage supervisor. The corresponding computer output was obtained by taking an average of 5 1-minute readings from

Trend Log or from an Immediate Status value obtained from the computer operator.

**Appendices 4 and 5** summarize the performance of 3 pipe J-Tec's compared with Trend Log and Immediate Status values. Average availability over 36 inspections by Trend Log was 100% and it's weighted average error of the mean output at 95% confidence level was only about 30 cfm greater than the averaged measured value of 630 cfm. However the average error from specific instruments ranged from 250 cfm less to 270 cfm greater than the measured value. Using the Immediate Status, the overall availability over 47 inspections was 79%. The average error from specific instruments ranged from about 140 cfm less to 130 cfm greater than the measured value with an overall average of about 92 cfm less than the average measured value of 660 cfm.

The major problems with the pipe J-Tec's were:

1. Water in the methane drainage line at the instrument location caused erroneous readings.
2. Precise calibration of the instrument was difficult because the only possible comparison was with the sum of flows from 15 to 25 boreholes, measured at other times by other personnel.

#### 4.1.5 BM2H 0-100% Methane Monitors

Computer output from the BM2H monitors was verified by comparing it with the local values displayed on the control units in the mine. During the study, 4 gas analyses were also performed which indicated that the control unit meter values were approximately correct. The computer output was either an average of 5 values taken at 1-minute intervals from Trend Log or the Immediate Status value obtained from the computer operator.

**Appendices 6 and 7** summarizes the performance of 4 BM2H units compared with Trend Log and 3 units compared with Immediate Status. Average availability over 44 inspections was 98% by Trend Log inspections and 93% by Immediate Status. Average error of the mean output was only about 10% $\overset{CH_4}{\wedge}$ greater on the computer than at the control unit.

The major problem with the BM2H readings was that the computer software was unable to correct for the non-linear output of the instrument. Lab tests of the BM2H indicated that at gas concentrations of about 55%, by neglecting the characteristic non-linear response, an output of about 64% would result. This accounts for the consistently high error in the observed computer output values.

Another problem occurred when there was a water blockage in the methane drainage pipeline. In that event, the gas sample line to the BM2H unit was blocked and the instrument continued to monitor the gas concentration of the same gas sample.

### 4.1.6 Air Temperature Transducer

Output from the ambient temperature transducer located outside the fan house was verified by comparison with a thermometer installed adjacent to the sensor. The computer output was obtained by averaging 5 readings from Trend Log taken at 1 minute intervals.

**Appendix** 8 summarizes the performance. This transducer performed very well throughout the study. No problems were noted. Over 14 inspections it was 100% available and it's average error was only 0.38°C. higher than the measured value (average = 4.24°C.).

### 4.1.7 Barometric Pressure Transducer

Output from the ambient barometric pressure transducer was verified by comparison with values reported by the Sydney Weather Office, corrected for the elevation difference. The Conspec output was an average of 5 readings from Trend Log taken at 1 minute intervals.

Over 16 inspections this transducer appeared to have 100% availability (**Appendix** 9). At 95% C.L. the average maximum error of the mean output ranged from 0.6 less to 1.8 inches of mercury higher than the actual measured value. It was later shown that the instrument's calibration was in error. Attempts to calibrate it failed, and near the end of the study, the computer output became constant at 31.69 in. Hg. It was later returned to the manufacturer for repairs.

### 4.1.8 Fan Water Gauge Transducer

Output from the differential pressure transmitter monitoring the exhausting fan's ventilation resistance was verified by comparison with a U-Tube water monometer installed at the fan. Output from the computer was obtained by averaging 5 readings from Trend Log at 1-minute intervals.

**Appendix 10** summarizes the performance of this transducer. Over 13 inspections, it was judged to be available 100% of the time and had an average maximum error in it's mean output of only about 0.3 in. w.g. greater than the measured value (average = 22.2 in. w.g.).

No major problems were noted with this transducer.

### 4.1.9 Mechanical Transducers

Performance of the mechanical transducers were not studied in detail during the study. Most of them were either not commissioned, were not giving consistent readings, or were giving readings that could not be verified.

On one occasion a test of the pumping station transducers was possible by comparison of the output of 2 All Points Logs -- one when the pump was stopped and another after it had been started. Outputs for the contactor status, earth leakage, and motor overload binary status transducers did not change although these points were being scanned by the computer at the time. Similarly it was not possible to determine if the pump temperature and vibration switches were operating properly since their binary output remained at "normal". Also, the pump discharge pressure did not show significant change, whether or not the pumps were running. Computer output from the discharge water flow transducer was erratic for the duration of the study. The discharge water flow meter at the outstation also gave erratic output indicating that the transducer may have been working properly but may have been located improperly.

Output from the sump water level transducer generally provided good correlation with the indicator located at the outstation. Output from the pump motor current transducers were inconsistent and may have been improperly addressed. Only 1 of 2 pumps was installed at 6 Drive pumping station. When 1 pump was operating the local meter showed about 80% of full scale, but the computer output consistently showed a communication failure. However computer output for the amperage transducer for the non-existent pump showed 0, 60, and 68 amps at the times that the other existing pump was operating.

The transducer monitoring fresh water flow into the mine gave inconsistent results at the beginning of the study. Later modifications provided reasonable trends showing increased water usage during shift operations, however the accuracy of the indicated flow rates could not be verified. Mine personnel utilized the output from this transducer to evaluate the difference between water usage during production periods and that during weekend or vacation shutdowns.

In order to prevent a constant alarm during shutdown periods when water usage was very low, it was necessary to create 2 separate points for this transducer. One point was used during production periods and had high alarm settings. The other point was used during shutdown periods and had low alarm settings.

Binary switches on the ventilation doors on 2 Deep, near 5 west, were installed as a safety precaution to show the computer operator and 2 Deep hoist operator when these doors were opened or closed. During several inspections the position of the doors was verified by either checking their status on Trend Log at that time or by communications with the computer operator to check their immediate status on the screen. These switches appeared to work properly throughout the study.

## 4.2 Airflow Transducer Tests

### 4.2.1 J-Tec Lab Calibration

The high variability of the output from the J-Tec transducers suggested that either these instruments were not suited to the application, did not respond to the manufacturer's stated performance specifications, or were not being calibrated properly. Therefore, during this study an effort was made to evaluate the situation and propose a solution.

The manufacturer states that the J-Tec VA-216B provides a linear response over the stated range (0.4 to 2.0 volts, 50 to 3000 ft./min) to an accuracy of ± 2% of full scale. Actual tests of one J-Tec using the wind tunnel at the Cape Breton Coal Research Laboratory (C.B.C.R.L.) is shown in **Figures 39-41**. The instrument is equipped with a "span" control which serves to vary the gain of the output at a given flow velocity. In this test the span was adjusted so that at a velocity of 3000 ft./min, the output was 2.0 volts. **Figure 41** shows the output of a J-Tec at full span and with the span control adjusted to give 2.0 volts at 3000 ft./min.

**Figure** 39 shows that with the span adjusted, the J Tec provided a linear response with a regression coefficient of 0.998. The maximum departure of the regression line from the specified response was about 4.5% at 50 ft./min. The maximum error in linear performance was about 2.9% at 200 ft./min. (**Figure** 40).

It is probably unfair to judge the J-Tec performance on only 1 test however the results do indicate that the manufacturer's claimed accuracy is reasonable.

### 4.2.2 J-Tec Mine Calibration

#### 4.2.2.1 Specified Method

Since the specified mine calibration procedure is complex, an effort was made to try and simplify it and perhaps improve the precision at the same time. The recommended procedure may be demonstrated by referring to

Figure 42 and summarized as follows:

1. The ventilation officer measures the air velocity at the sensing head and the average quantity of airflow in the airway. Since the detector head is not necessarily located at the point in the airway cross section where the point airflow equals the average airflow, its output velocity multiplied by the actual area may not yield the correct average airflow. To compensate, an artificial area is calculated.

   $$\text{Artificial Area } (A_i) = \frac{\text{Average Flow Rate (Q)}}{\text{Point Velocity } (V_i)}$$

   In **Figure** 42 the average flow was about 39,000 cfm, the point velocity was 500 ft./min., and the artificial area about 78 ft.$^2$.

2. The J-Tec transducers being used have a nominal response of 0.4 to 2.0 volts over a range of 50 to 3000 ft./min. Of the 256 data bits available to represent the J-Tec output in the digital signal, 51 are lost to reach the 0.4 v. offset. The correction factor to convert the remaining 204 bits to quantity may be calculated as follows:

   $$\text{Correction Factor (CF)} = \frac{(3000 - 50)\ (A_i)}{204}$$
   $$= 14.4608\ A_i\ \frac{\text{cfm}}{\text{bit}}$$

   To compensate for the first 51 insignificant bits, they must be deducted from the displayed quantity (i.e. - 51 bits X cf). Also, since the 0.4 v. output occurs at 50 ft./min. rather than zero, this "overlooked" quantity must be added to the displayed value (i.e. + 50 $A_i$).

   The general form of the calibration equation is:

   $$y = ax + b$$

   Where: $x$ = Number of usable bits (0 to 255)
   $a$ = Correction Factor
   = 14.4608 $A_i$ cfm/bit
   $b$ = Offset
   = 50 $A_i$ - 51 CF
   = - 687.5008 $A_i$ CFM

3. In the example shown in **Figure 42** the J-Tec span control is initially in the full position. At 500 ft./min. it has an output of about 0.82 v. which generates about a 105 bit digital signal. By applying the correction factor and offset calculated above for the manufacturer's specified response, the resulting displayed quantity would be about 66,000 cfm. An adjustment of the span control is necessary to complete the calibration by forcing the actual response back to the specified response value. The result is shown in **Figure 42.** At the adjusted span the displayed output is now 39,000 cfm, the actual measured value.

### 4.2.2.2 Alternative Method

It can be seen from **Figure 42** in the preceding example that the correction factor (cfm/bit) might have a significant effect on the variability of the displayed J-Tec output. In the specified calibration procedure a change of 1 bit would change the output by 1128 cfm. If the span control could be left in the full position a change of 1 bit would change the output by 650 cfm, a significant improvement.

The alternative method derived during this study takes advantage of this capability. In addition the accuracy of the calibration procedure can be further improved by comparing the mean of several ventilation measurements to the mean of 10 displayed values, both taken at the same time. The entire calibration can be performed by 1 person.

The alternative method may be demonstrated with reference to Figure 43 and summarized as follows:

1. Set Trend Log to record the computer output for the points to be calibrated at 1 minute intervals. Proceed underground and measure the average quantity and velocity at the sensor. Calculate $A_i$. To test that the instrument is responding normally to ventilation changes, block the sensor and later check that it's output while blocked was equivalent to no more than 51 bits.

2. In the central monitoring station calculate the average output quantity from 10 Trend Log readings taken at the same time as the underground measurements. If the output value differs significantly from the measured value a correction to the present calibration is necessary.

   $$\text{Required correction} = \frac{\text{Measured Quantity}}{\text{Output Quantity}}$$

   $$\text{For example,} \quad = \frac{40{,}000}{50{,}000} = 0.8$$

3. Calculate the present average flow from 10 readings from the continuous output on the screen (say 48,750). The corrected value should therefore be about 39,000 cfm. Set C.F. = 1.0 and offset = 0 on the computer and observe the average bit output at 39,000 cfm (say 105 bits). Since at 51 bits the flow is specified at 50 ft./min. ($Q = 50\ A_i = 50 \times 78 = 3900$ cfm), we now have 2 points with which to calculate the equation to transform bits to cfm. Using the points (51,3900) and (105, 39000) the calibration line is:

   $$\text{Quantity (cfm)} = 650 \times \text{Bits} - 29250$$

   Enter 650 as the C.F. and - 29250 as the offset. Verify that the new output is about 39,000 cfm.

### 4.2.2.3 Comparison of Calibration Methods

To test the effectiveness of this alternate calibration technique, 2 transducers, 356 and 357 ( 9

East Top Level inbye 500 and 1000 meters), were alternately calibrated using each technique and their performance evaluated over a period of time.

**Table 9** summarizes the results of the test. There was no significant difference in the average standard deviation of the output for each calibration method. Thus, the high variability of J-Tec readings does not seem to be related to the calibration procedure.

The test did demonstrate that the alternate calibration procedure was much simpler and could be performed by only 1 person. It was later shown that this method should be applied to other airflow transducers that did not have span control (eg. Trolex Airflow Monitor).

### 4.2.3 Trolex Airflow Monitor

A Trolex airflow monitor (Model TX1322) and analog meter (Model TX7022) were obtained for testing. This instrument utilizes the same "vortex shedding" principle as for the J-Tec. The manufacturer specified a range of 0.4 to 2.0 volts, 0.5 to 25 m/sec at an accuracy of ± 2% of full scale.

**Figures 44-46** show the results of a lab calibration of one Trolex instrument using the wind tunnel at the Cape Breton Coal Research Laboratory. The transducer response was linear with a regression coefficient of 0.9997. The maximum departure of the actual response line from the specified response was 28.5% at 25m/s. The maximum error in linear performance was about 1.8% at 25 m/s. The displayed values on the Trolex monitor also responded linearly to velocity however it had a maximum departure from the specified response of about 40% at 25 m/s.

To test the performance in the mine, a Trolex instrument was installed near Point 356 (9 East Top Level J-Tec, 500 meters inbye). The output from the Trolex is compared with that from the J-Tec in **Table 10**. The standard deviation of the Trolex output was slightly worse than for the J-Tec, although it had slightly better availability. During this test the J-Tec demonstrated it's curious behavior of giving a high output when blocked. It was later suggested that perhaps induced currents in the J-Tec's power line were causing this, however in any case, the same problem was not seen with the Trolex.

Mine calibration of the Trolex was performed using the alternative method described previously since no span control was available. There was no provision to calibrate the Trolex monitor which was installed beside the sensor. As a result, the displayed values were completely inaccurate and were not reported.

The test demonstrated that the Trolex performance was about the same as for the J-Tec. It did not improve the problem with high variability of output.

### 4.2.4 Sieger BA5 Airflow Sensor

The new Transmitton remote monitoring system installed at Prince Mine utilizes the Sieger BA5 airflow monitor. It also utilizes the vortex shedding principle and has local output display and battery backup, but also is equipped with time constant dampening and selectable velocity ranges.

Figure 47 shows the performance of a Sieger BA5 over its velocity ranges as measured with the C.B.C.R.L. wind tunnel. Figure 48 shows that in the 0 to 2 m/sec. range, the actual response had a linear regression coefficient of 0.999 and a maximum departure from the specified response of 28%. In the 0 to 5 m/s range (Figure 49), it was also very linear and had a maximum departure of 10%. At 0-10 m/s range, (Figure 49) it was also very linear and had a maximum departure of 10%. At 0-10 m/s range (Figure 50), the response was linear and the departure was 7.3%. **Figure 51** shows the response at the maximum range of (0-20 m/s). The linear correlation coefficient was 0.999 and the maximum departure from the specified response was 5.5%.

Several readings were also taken at 2 BA5 instruments in Prince Mine and compared with actual ventilation measurements. **Tables 11 and 12** show that the average standard deviation of the output was about 1200 to 1700 cfm, about 2.7 to 3.2% of the mean output. This is much better than for the J-Tecs which in similar flow conditions would probably have a standard deviation of about 3200 cfm, about 6.5% of it's mean output.

It was concluded that the Sieger BA5 probably had lower variability due to it's built in and selectable time constant dampening. During the tests at Prince a 15 second constant was used.

### 4.2.5 Effect of Time Constant Dampening

**Figure** 52 demonstrates the effect of the RC time constant dampening. J-Tec and Sieger BA5 instruments were alternately placed in the wind tunnel and flow (800 ft./min) was interrupted by placing an obstacle in the flow path for about 1 second in 5 seconds. The J-Tec, which was found to have an equivalent RC of 1.4 sec, reacted abruptly with its output dropping rapidly to about 44% in the first second and recovering to 100% in the following 4 seconds. The BA5, set for a 15 sec. RC constant, dropped only about 6% in the first 1.5 sec and did not recover. Over a longer time period its output would stabilize at about 4/5 of the original flow since the flow was being interrupted 1/5th of the time.

The significance of this is obvious. For an instrument without sufficient dampening, output will vary rapidly with changes in airflow. An instrument having greater dampening will respond more slowly to airflow changes. It will have less variability and its output will more closely match the mean value.

By adding a time delay constant, the response time of the instrument will be affected but not by a significant amount for this application. There is very little need to know the instantaneous velocity or to witness the small variations. An average value over 15 or even 60 seconds would be acceptable and would show much less variability.

### 4.2.6 Recommendations

1. The test results indicate there is no difference in output as a function of the calibration method. However, since the alternate method can be carried out by only 1 person and applies to

other types of airflow transducers not having span control, we recommend CBDC adopt this method.

2. Wind tunnel tests demonstrated that the manufacturers stated accuracy is reasonable.
3. Only the instrument having the selectable RC time constant provided significantly better response. We recommend that either the present J-Tecs be modified to give a time constant of about 30 sec., be replaced with Sieger BA5 transducers, and/or the capability of utilizing a software averaging routine should be added to reduce the variability of the output.

## 4.3 Computer Performance

### 4.3.1 Assessment Method

In order to assess the performance of the major hardware components, other than the transducers, and of the various software features, all of the problems noted during the 12-month study were noted and summarized. Since the project technologist could not be present at all times, only those problems were recorded which were witnessed during his attendance on day shift and those which could be derived from system print-outs (eg. shift report, alarm summary, etc.) at other times. In addition, where a problem was known to continue over a prolonged period, such as when the printer was broken, its full duration was recorded.

### 4.3.2 Hardware Performance

Appendix 11 lists the system performance problems that were noted during the study according to their date of occurence. These are grouped by component in Appendix 12. Table 13 summarizes the incidence of each problem, its frequency and resulting down time. Most downtimes were attributed to poor hardware reliability. A few are software related, but are included because they caused significant downtime of the monitoring system. A description of each of the main problems in the summary table is given below:

1. Monitoring System Inoperative While Performing Diagnostics:

   To help solve the frequent communications problems with new outstations, the Diagnostics software feature was used. However while in Diagnostics, the rest of the monitoring system was inoperative. This was not acceptable. Software changes installed in October, 1986 solved this problem.

2. Senturion 200 Disk Drive Sensitive to Dust:

   Dust and dirt in the Central Monitoring Station got into the disk drive and began to cause frequent read/write errors. Earlier, write errors were undetected until a re-boot of the computer was necessary and the faulty disk would not work. Later a "Disk Verify" software option allowed the errors to be detected immediately. However, the dust continued to be a problem and the disk drive had to be disassembled and cleaned. While it was being cleaned the monitoring system was inoperative for 5 1/2 hours. This problem is ongoing.

3. Senturion 200 Disk Drive Failed:

   Even after cleaning the disk drive, it did not function properly. It was judged to be worn out and a replacement was installed. During the installation, the monitoring system was inoperative for 2 hours. The new disk drive worked well although its life is also questionable.

4. Software Incompatibility:

   A revision of the Senturion 200 Software did not accept the previous system configuration stored on the "Status Disk". As a result, all of the information had to be re-entered and the monitoring system was inoperative for 1 shift.

5. Senturion 200 Crashed For No Apparent Reason:

   On 16 different occasions it was noted that the Senturion 200 crashed without any apparent reason. These crashes necessitated re-boots of the system that were often difficult with the persistent problems with the disk drive. Resulting down time averaged about 30 minutes for each incident. This problem may be ongoing.

6. Senturion 200 Crashed With Save On Disk Command:

   On 1 occasion the system crashed when the save on disk command was attempted. This caused 30 minutes of down time. This problem did not recur after the new disk drive was installed.

7. Quay 910 Crashed For No Apparent Reason:

   At unpredictable times the Quay 910 computer would stop operating for no apparent reason. To restart it required a system re-boot from the disk. While inoperative, the Senturion 200 system continued but the graphics functions did not work and valuable data was lost. This problem was noted on at least 6 different occasions and caused a total down time of at least 26 hours. The problem is ongoing.

8. Winchester Disk Drive Failed:

   The Winchester hard disk drive on the Quay 910 developed a bad sector and would not support the operating program. It was removed in Nov./86 and sent to the supplier for repairs. It was returned March/87.

9. Floppy Disk Drive For Quay 910 Sensitive to Dust:

   The floppy disk drive functioned intermittently due to mechanical and/or dust problems. Repeated attempts were necessary in order to complete read/write tasks. After repairs it worked well, but the dust problem is ongoing.

10. Quay 910 Crashed During Power Failures:

The UPS (battery backup) could not support the Quay 910 during a power failure. In order to reboot the Quay 910 during a power failure, one color terminal and the color printer had to be shut off. This happened at least 3 times with a total down time of at least 1.8 hours. For the duration of the study the UPS was judged to be unreliable. The problem is ongoing.

11. Televideo CRT Screen Dim:

On at least 2 occasions the Televideo CRT screen became very dim and hard to read. This problem was experienced over about 1 month. The internal brightness control was used to improve the brightness. The problem is ongoing.

12. Mannesman Tally Printers Overloaded:

On at least 3 occasions 1 of these printers ceased operating. On one occasion a fuse was blown. On another, a circuit board was burned out and the printer was returned for repairs. It was suspected that due to dust getting into the print head and paper feed mechanism, the circuits may have overloaded. Total down time for both printers was over 6 months. The dust problem may be ongoing.

13. ISC Color Printer Failed:

After being idle for several months the quality of the color print was very faded. On one occasion it was unavailable for about 9 days while repairs were made to a burned out circuit board. This was probably caused by a short circuit due to ink leaking onto the electronic components.

14. Intermittent Fuse In Canmet Outstation:

For about 1 week, communication problems were experienced with the Canmet outstation. At first the problem was thought to be related to MODEM tuning, however later an intermittent fuse in the trunk line was located. The fuse was replaced and normal operation resumed.

15. Battery Backup On Canmet Outstation Defective:

    During a power failure the safety disconnect on the battery backup did not function properly and caused the outstation to be off needlessly for about 6 days. Subsequently the battery backup was judged to be unreliable for about 3 months at which time mine staff made successful modifications to it.

16. Faulty Accessor Card:

    During the commissioning of Canmet's outstation, a faulty accessor caused communications problems and was interfering with the communications from another accessor card. The defective card was found to have an overlapping solder trace on its printed circuit board. The faulty card was removed. Down time was about 15 hours.

17. Faulty J-Tec Blew Outstation Fuses:

    Canmet's outstation was out of service for about 10 days while searching for a problem that caused blown fuses in the outstation. The problem was traced to a possible ground fault in a J-Tec. The instrument was changed and the outstation turned on.

18. Canmet Outstation Unable To Drive Long Trunkline:

    The outstation was unable to drive the local J-Tec trunkline on the 9 East Panel which was about 11,500 feet long. This caused frequent communications problems with several of the J-Tec transducers over a period of about 6 months. Later, terminating resistors were added and the trunk line began functioning. Later after receiving EMR approval, Conspec trunk extenders were used successfully. Further extension of the trunk line may not be possible.

### 4.3.3 Software Performance

The major software problems that were noted during the study are summarized below. Some of these are serious in that they affected the usefulness and reliability of the monitoring system. Others may be categorized as desirable additions that would probably increase the system usefulness, if adopted.

#### 4.3.3.1 Senturion 200

1. Alarm Buffer Full Caused Computer To Crash:

   Usually the alarm buffer worked well for a low rate of alarms. However, a high rate of alarms occasionally overwhelmed the console operator's ability to acknowledge them successfully and the system crashed. The problem is ongoing.

2. Shift Report Gave Reasonable Values Even Though Point in C.F.:

   When a transducer was dead, the shift report gave the impression that the transducer was working properly. This was misleading. The problem is ongoing.

3. Immediate Status Request May Show Normal But Point Not In Scan:

   Sometimes when a transducer was not being scanned, the computer gave a misleading normal reading. The problem was noticed in October/86 shortly after the new software was installed. The problem is ongoing.

4. Occasionally CF Message Was Not Displayed After A Point Removed From Scan:

   Normally when a point was taken out of the scan, it was displayed on the screen/printer as being in communications failure. Occasionally, a certain point did not do this. The problem was noted after the new software was installed in October/86 and may be ongoing.

5. Extra Characters On Televideo Screen (Gibberish):

   At rare times in the study period, the screen displayed gibberish or put itself in Diagnostics. The system then had to be re-booted. The problem may be ongoing.

6. Difficulty Getting "NO" Option For Horn Option In "NEW":

   In one instance, the computer would not accept a change in the "NO" option for the horn to sound. The problem may be ongoing.

7. No Local Indicator That Computer Is Down - i.e. At Console/Hoist:

   The console operator had no immediate indication that the computer was down. The screen remained unchanged displaying static readings from before the crash. #2 Hoist operator's warning lights also remained unchanged. The problem is ongoing.

8. Nuisance Alarms Overshadowed Real Alarms:

   Steady repetitive nuisance alarms from intermittent points in need of repair and other events such as pumps starting and stopping overshadowed serious alarms such as a high % of methane. This problem is ongoing.

   A problem also existed with certain points when the time delay to alarm was too short or the alarm settings were too narrow. In this case frequent alarms resulted from normal operations such as when ventilation doors were opened temporarily to allow the passage of mine transportation. The problem was reduced after more realistic alarm settings were entered by mine staff however further evaluation may be necessary.

9. Insufficient Training, Documentation and Advice:

   Solutions to system problems were attempted by the remote monitoring crew, however, their knowledge and experience with the system was limited due to inadequate training, documentation, and advice from the supplier. As a result, it often took a long time to correct the problems. This situation was partly a result of the Conspec System not being perfected for coal mine applications. Over a period of several years as the staff became more experienced and with further system improvements by CBDC, this problem became less prevalent.

10. Insufficient Software Diagnostics For Outstation Commissioning:
There was no software to guide the Operator when a multitude of communication problems occurred during the commissioning of an outstation. The problem is ongoing.

11. Status Disk Save Did Not Have A Verify Option:

A verify disk feature is necessary to insure that all of the system description information is accurately copied to disk. Without this option, attempts to read the disk on subsequent system start-ups occasionally failed because the information may not have been properly written. In this event all of the data had to be reentered manually causing several hours of downtime. New software introduced in October/86 included a Disk Verify feature which solved this problem.

12. Unable To Handle Nonlinear Transducer Output:

Special consideration must be used when using nonlinear transducers such as a 0-100% BM2H methane detector or a differential pressure flow transmitter. The system assumed all transducers are linear. The output of nonlinear transducers was therefore incorrect. The problem is ongoing.

13. Unable To Easily Store Data On Floppy Disks Or Tape:

There was no software option capable of permanently storing historical data such as trend graphs and shift reports. The problem is ongoing.

14. No Online Accessor Checker, System Had To Be Down To Use Diagnostics:

The monitoring part of the system had to be shut down when using Diagnostics to trouble shoot communications problems. New software introduced in October/86 ended this problem.

15. Only 10 Points Available In Trend Log:

Currently there are usually 6 transducers on a longwall district. More than 10 points were occasionally needed in Trend Log in order to monitor more than one district at one time. The problem is ongoing.

16. Only 30 Points Available In Shift Report:

    Shift report was too limited with only 30 points reported. Frequently many important system transducers had to be left out of this report. The problem is ongoing.

17. Simple Addition Such As Adding Two Airflows Cannot Be Done:

    Software is unavailable to do a simple addition of two readings. For example, the total return ventilation is monitored with a J-Tec air velocity sensor in each of the two return airways. The total return must then be calculated manually. The problem is ongoing.

18. False Accuracy In The Display Of Analog Values:

    The display of analog values gave too many insignificant digits that could cause misinterpretation by users. For example, a BM1 output of 0.9408% CH4 really should be rounded to 0.9%, and a J-Tec output of 85049 cfm should be rounded to the nearest 500 cfm, i.e. 85,000 cfm.

19 Fluctuation Of J-Tec Values:

The J-Tec transducers responded instantly to normal turbulence of airflow. As a result the displayed values often showed large variations that did not always reflect the true average airflows. There was no software feature to allow the display of a moving average over a selected time interval such as 15 to 30 seconds.

#### 4.3.3.2 Quay 910

1. Clock Ran 20 Minutes Fast Each Day - Trend Software Crashed:

   The Quay 910 graphics computer added 20 minutes to its time each day. The clock had to be manually reset each day but this occasionally resulted in the graphics software crashing. The problem is ongoing.

2. Color Graphs For Some Points Had Incorrect Y-Coordinate:

Even though the Senturion 200 displayed a correct value, the Quay 910 occasionally displayed incorrect Y-coordinates on the color graphs. The problem is ongoing.

3. Graphics Show Reasonable Output Even Though Point In Computer Failure:

   A transducer can be no longer in operation but a graph plotting its output occasionally showed a seemingly reasonable output. This was very misleading. The problem is ongoing.

4. Longer Than 2 1/2 Days For Graphs Unavailable; Later Only 7 1/2 Hours:

   Software was supposed to graph data from weeks and months in the past but 2 1/2 days was the longest history available. Later when the Quay 910 returned from being repaired only 7 1/2 hour graphs were available. The problem is ongoing.

5. Certain Software Such As Equipment Stoppage Analysis Didn't Work:

   Software packages such as Alarm Instruction Phrases, Equipment Stoppage Analysis, and Preventative Maintenance Work Orders are resident in the computer but not easily used. Equipment Stoppage Analysis if used would cause the graphics program to crash. The problem is ongoing.

6. Sequence Of 7 Keys Needed To Obtain Graph Printout:

   Each time a graphics hardcopy was needed, seven key strokes were necessary. The original 2 keystroke sequence did not work. Conspec's representative was able to reprogram the print command for a graphic display printout but was unable to fix the more commonly used graph print command.

7. Display Of One Point Alarming Sometimes Caused Other Points To Alarm:

   On a display screen a point in alarm correctly showed its value in red alphanumerics. Neighboring points could incorrectly show red also. New software introduced in August/86 solved this problem.

8. Color Printer Ran On Indefinitely, Printing The Same Graph:

   The printer printed the same graph over and over again if left unattended. When a graph is finished, the color printer had to be manually reset. The problem is ongoing.

9. Two Display Screens With Same Readouts Did Not Both Update Properly:

   One screen continued to display one set of values while the other screen successfully updated. The problem is ongoing.

10. Only 30 Points available On Quay To Be Graphed:

    The graphics software can only graph the history of 30 points. The remaining points cannot be graphed and valuable management information is being lost. The problem is ongoing.

11. Unable To Easily Store Data On Floppy Disks Or Tape:

    Storing historical graphics data was only possible by printing out the information on paper. This was time consuming and impractical. Software is needed to store this data on floppy disk or tape. The problem is ongoing.

12. Trend Graph Hard To Read - No Auto Scaling Or Point Descriptors:

    In order to display a graph, the Y scale had to be set manually. Automatic scaling is desirable. The graphs had no title describing the point, only a point number. The % figures on the Y scale were distracting and uninformative. The graph should have a size and color option to allow printing in black and white on a smaller sized paper for easier handling and filing.

13. Difficult Procedure To Set Up Process Displays:

    Although the software had the capability to store and display up to 256 separate, very useful, and informative displays of updating transducer values in user defined configurations, the programming to set them up and make changes was very involved and time consuming.

14. Insufficient Software Maintenance By Supplier:

Many of the above problems were discussed with the supplier during a site visit in August of 1986, but most are still ongoing. Despite repairs to the Quay 910 by the supplier during the period Nov./86 to March/87, the original software was not corrected.

### 4.4 Management Usefulness

Lingan's Conspec remote monitoring system has been useful to mine management although not to the degree it was hoped. Frequent communications failures, inaccurate readings, nuisance alarms, and poor availability of the Quay 910 system made it difficult to accept as a reliable mine management system.

Early in the study, nuisance alarms (such as a point coming in and out of communication failure or when the alarm levels for certain transducers were set too close to the normal) overshadowed real alarms. As a result they were often neglected. Later attempts to reduce the nuisance alarms considerably improved this situation. With the computer now monitoring the fan, staff are closely watching the alarms and respond quickly when a critical one occurs.

The most useful output has been the immediate status of BM1 readings in the wall returns and main return, fan flow and waterguage, $CH_4$ extraction plant % suction, and the 2 deep door lights. Due to the high variability of their output, the J-Tec readings generally were not trusted. The methane drainage readings were also not used because their accuracy is questionable. Most of the pumping station transducers did not work properly during this project and generally their output was ignored by mine staff.

The BM1 readings were used extensively by mine management, supervisors, and engineers to monitor CH4 levels in each longwall, in the main return at the fan, and to verify the use of mine transportation in No. 2 slope. On the longwalls, BM1 readings were used to check if there was sufficient ventilation to dilute the CH4 produced during production shifts, to monitor the status of gas feeders and the effectiveness of control measures, and to monitor the effects of stopping the CH4 extraction plant. At the main fan, the BM1 output is used to determine when CH4 extraction from the sealed longwalls is necessary in order to control the outward expansion of gas into the ventilation air in times of falling barometric pressure. On No. 2 Slope, one of the main return airways, transportation of men and materials is permitted as long as the % CH4 is below 1.25%.

After Shift Report was successfully initiated by staff working on this research project, it was quickly adopted by mine management. A daily shift report for a 24-hour period was programmed for output at 7 a.m. each morning. It included the average values over the 24-hour period for fresh air flow, %CH4 in the intake and return, and CH4 drainage flow and %CH4 for each operating longwall. In addition the average for airflow, %CH4, and watergauge, barometric pressure, and fresh water flow were included. This provided management with a general daily overview of the mine ventilation performance at a glance.

When the Quay 910 was operating, management also frequently requested 48-hour Trend Plots for %CH4 in the longwall returns, fan flow, %CH4, and watergauge, and fresh water flow. The latter output was useful to determine the continuity of production on each longwall since fresh water usage showed a good correlation with shearer operation.

The mimics or process displays, when operating, were also very useful. They showed the complete status of all the transducers in a given process such as long wall ventilation, fan performance, or CH4 extraction plant performance. Without these displays the status is more difficult to obtain since the immediate status of each transducer must be requested individually.

Numerous other special applications were noted during this study. During the summer vacation shutdown in 1986 the main fan was off for repairs and temporary auxiliary ventilation was utilized. Mine staff utilized the remote monitoring system to confirm that the auxiliary fans were working properly and to monitor gas levels underground. Other uses included:

- When there was a roof fall on 2 slope, management checked its effect on fan air flow and watergauge using the trend plots.
- The CH4 drainage capture efficiency was often estimated using the fan air flow and % CH4, and the calculated flow from the extraction plant.
- An attempt was made to correlate barometric pressure drops to the increased leakage of CH4 from the sealed longwalls and the effectiveness of CH4 drainage from these areas as a control measure. Trend plots showed a definite improvement in Fan CH4 after CH4 drainage was initiated, however the barometric pressure transducer gave inaccurate readings.
- When the 9 East cundy was connected in September 1986, ventilation officers used the readings from the airflow and % CH4 transducers to confirm that proper wall ventilation was established.
- When Canmet and the USBM conducted a CH4 emission study in the summer of 1986, the monitoring system was used to indicate wall ventilation status. The output values were not used however, since more accurate test instruments were available.
- Before radon gas test equipment was used underground by the Nova Scotia Department of Mines, CH4 levels were first checked on the remote monitoring system.

# CHAPTER 5.0 9 EAST STUDY

## 5.1 System Description

The normal monitoring system installed at Lingan included ventilation transducers on each longwall panel. Normally these included:

- 1 J-Tec airflow sensor at the outbye end of the intake airway
- 1 J-Tec airflow sensor at the outbye end of the return airway
- 1 BM1 CH4 sensor at the outbye end of the intake airway
- 1 BM1 CH4 sensor at the outbye end of the return airway
- 1 J-Tec airflow sensor in the outbye end of the methane drainage pipeline in the return airway.
- 1 BM2H CH4 sensor in the outbye end of the methane drainage pipeline in the return airway.

In addition, a BM1 CH4 sensor is also situated in the return airway, inbye a cundy, if one exists.

To study whether data from remote monitoring would permit a more detailed assessment of airflow leakage, and CH4 production patterns, additional transducers were installed. Since the existing CBDC 9 East Outstation did not have sufficient capacity to accommodate the additional transducers, it was necessary to purchase and install a separate outstation (9 East Canmet Outstation).

To reduce the amount of wiring, it was decided to try the remote accessor trunk line design whereby up to 6 J-Tec airflow sensors, each with built-in accessor, would be powered from one power cable and would transmit their digital signals back to the outstation via a single trunkline signal cable. This differed from the normal CBDC arrangement whereby each J-Tec has it's own separate power and signal cables, and the analog signal (4 to 20 mA D.C.) is transmitted back to it's accessor card located in the outstation.

6 BM1 CH4 sensors were also installed, however due to their power requirement, each required its own power cable. The analog signals from the BM1's were transmitted to their accessors located in the outstation via separate pairs in one 6-pair communication cable. This further reduced the number of cable runs since the normal CBDC arrangement provided a separate signal cable to each BM1.

A further difference between the CBDC 9 East Outstation and the 9 East Canmet Outstation was that the latter had no local alarm or local trip/relay capability. Both were similar in that each was equipped with communications equipment to allow voice communication between the outstation, each sensor location, and the Central Monitoring Station.

The additional transducers initially installed for this study included:

- In the return airway a J-Tec and BM1 were installed at each of 3 locations, 450, 940, and 1400 meters inbye of No. 5 slope
- In the intake airway a J-Tec and BM1 were installed as close as possible to the face at the time, about 1545 meters inbye of No. 5 slope

Later, after the 9 East cundy was introduced around September, 1986 J-Tec's were installed in the return airway outbye the cundy ventilation doors, inbye the cundy, and as close to the face as possible. BM1's were also installed in the return airway outbye the cundy doors, inbye the cundy, and close to the face. With a fresh air split then flowing in the top level to the cundy, the instruments installed earlier were deemed to be redundant and were removed. Also, the BM1 about 1545 meters inbye on the bottom level was moved further inbye nearer the face, 1940 meters inbye 5 slope.

The locations of the 9 East monitoring equipment is shown on Figure 9. The service dates when each transducer began or ceased operation is shown in Table 2.

## 5.2 Data Acquired

In order to capture all of the data from Lingan's remote monitoring system for ventilation research, Canmet acquired a Conspec Model 10 Graphics Processor. It was installed at C.B.C.R.L. in Sydney and connected to Lingan's Senturion 200 via a 1200 baud modem and telephone link. the system installed at Canmet included the following:

- 1 Conspec model 10 Graphics Processor with 1 meg. RAM.
- 1 Intercolor model 8810 Color CRT Terminal
- 1 Smith Corona Model D300 Dotmatrix Printer
- 1 Quadram Quadjet Color Printer
- 2 Winchester 20 Meg. hard Disk Drives
- 1 5 1/4 - inch 638 K. Floppy Disk Drive
- 2 General Datacomm industries Model 201C, 1200 baud modems.

The System 10 has the capability to generate, compile, and display color graphics Trend Plots and Mimics incorporating the status and alarm conditions of all the points monitored by Lingan's Senturion 200. It has the capacity to store up to 4 months of data on the hard disks, however the practice is to regularly download data to floppy disks for long term storage. Displayed output from the System 10 can be mimics or trend plots. The mimics are configured on the System 10 and show updated values at 10-second intervals. The trend plots can be for any 8-hour to 10-day period.

Canmet's System 10 was in operation from August 25, 1986 to October 24, 1986 at which time Lingan's Quay 910 malfunctioned making it impossible for the System 10 to receive information until May 22, 1987 when it also malfunctioned and had to be removed for repairs.

In addition to the direct transfer of data to Canmet's computer, considerable printed reports were acquired from Lingan's system. These included selected Trend Plots, Display Mimics, Shift Reports, Trend Logs, All Points Logs, Alarm Summaries, Descripter Lists, Analog Parameters, Correction Factor and Offset Tables, and Scan Listings. These reports were bound in monthly volumes and presented to Canmet to augment their computer data.

## 5.3 Problems Encountered

Acquisition of data for ventilation research was more difficult than expected. Problems encountered included:

1. Mine staff were very busy trying to get the existing system operational and in making changes in response to continual mine developments. As a result very little time was available to install, modify, and trouble shoot the research equipment.
2. The Canmet outstation was initially unable to drive the J-Tec accessor trunk line (about 10,000 ft.). It was found that up to 6000 ft. on the top level could work. As a result Point 361 (9 East Coal road Airflow - 1545 m. inbye) was modified so that it sent an analog signal back to its accessor in the outstation (ie. it was taken off the trunk line). Later, at the suggestion of

Conspec, terminating resistors were employed which did permit operation of the full trunk line. A further modification used a trunk extender provided by Conspec. It was found that when installed at the outstation, the trunk extender enabled the operation of the full trunk line (about 11,600 feet). However at this distance problems were encountered with communications failures, false signals, and inability of the J-Tec's to give zero output when blocked.

3. Significant downtime was experienced as a result of several minor problems that were difficult to trace. These included a conveyor belt cutting through the No. 2 main trunk line, a defective accessor card in the outstation having a solder overlap, blown fuses or intermittent fuses in the outstation, and poor quality wire leads and plugs in the outstation causing poor connections.

4. The battery backup on the Canmet outstation malfunctioned several times after power outages. Later a modification of the safety disconnect was made by CBDC which corrected the problem.

5. Problems with J-Tec response included:

   - In August, 1986 Points 357 and 358 had frequent communications failures and appeared to be stuck on a specific value. In September, Point 358 gave anomously low output.

   - In October and November, 1986 Point 361 (Coal Road - 1545 m. inbye) gave the same output when blocked. In December it was found that this transducer was interfering with the local trunk line operation, causing other accessors to experience communications failures. This point worked only intermittently for the rest of the project.

   - Point 356 (Top Level Air Flow - 450 m. inbye) occasionally gave 14 - 15 bit output when blocked. in January it gave a high output when blocked but when the accessor card input terminals were shorted computer output was zero (as expected). This indicated a fault with the J-Tec itself.

6. The BM1's worked very well. The output from Point 351 (BM1 Top Level - 940 m. inbye) was about 0.8% CH4 in September 1986 even while the instrument was turned off. The accessor card was removed and tested. With a constant voltage applied to the input leads, output from the accessor card climbed over about a 1 month period to about 195 bits. At that point it was disconnected and its input leads shorted, but its output remained at 195 bits. A similar phenomenon was noted with other BM1 accessor cards while testing their output while applying a known voltage input from a variable power supply. At 2.0 volts the output was correct at 255 bits. As the voltage was reduced, the bit output dropped such that at 0.06 volts the output was 8 bits. At 0.05 volts the bit output suddenly jumped to about 135 bits. This indicates a fault in the accessor card design that should be corrected.

## 5.4 Usefulness As A Research Tool

The ventilation data acquired from the Conspec remote monitoring system can be used for ventilation research. However, due to the failure to keep all of the transducers calibrated accurately it is necessary to verify the Conspec data with actual ventilation measurements as reported in the Appendices.

To demonstrate how the data may be used, the make of CH4 per tonne of coal production was calculated for 9 East longwall over a 48-hour period from August 27 - 29, 1986, before the cundy ventilation system was started.

Figure 53 shows the Trend Plot For Point 71 (9 East Top level CH4). On August 27, 1986 an inspection of this transducer indicated that its output was 0.16% CH4 too low. A corrected y-axis was calculated and drawn. Using a planimeter, the average gas level at this point was calculated to be 0.7732% CH4.

Figure 54 shows the Trend Plot for Point 72 (9 East Coal Road CH4). This instrument measured the background CH4 in the "fresh" air entering the district. In this case inspections revealed the instrument was reading accurately and no correction was necessary. By planimetry, the average CH4 concentration in the intake air over the 48-hour period was 0.0807%.

Figure 55 shows the Trend Plot for Point 75 (9 East Top Level Air Flow). This transducer measured the total airflow exiting 9 East. An inspection of this point 75 on August 29 at about 8:30 a.m. provided a measured airflow of 86928 CFM by the "hand-held" anemometer method. Previous comparison of the extension handle and hand-held anemometer methods at this location indicated the latter value should be corrected by a factor of 0.727. True airflow was therefore about 63179 CFM. A corrected y-axis was calculated and drawn. Using the planimeter, average airflow over the 48 hours was 62224 CFM.

The increase of $CH_4$ in the ventilation air in 9 East may be calculated as follows:

$$\begin{aligned} CH_4 &= 62224\ (0.7732\% - 0.0807\%) \\ &= 431\ \text{CFM} \\ &= 35{,}149\ m^3 \text{ over 48 hours.} \end{aligned}$$

Appendix 13 shows the R.O.M. Coal production (tonnes) as reported by Lingan Mine. During this 48-hour period the production was 5165 tonnes. The methane make in the ventilation air was therefore about 6.8 $m^3$/tonne.

To calculate the $CH_4$ quantity captured in the $CH_4$ drainage system the Trend Plots For Point 74 (9 East Methane Drainage Volume) and Point 73 (9 East Methane Drainage Concentration) are shown in Figures 56 and 57. In both cases a corrected y-axis was derived by calibration of the Conspec output to actual measurements. Using planimetry, the average flow was about 705 CFM and 57.4% $CH_4$. The $CH_4$ captured in the $CH_4$ drainage system was therefore about 33,000 $m^3$ over the 48-hour period, or 6.4 $m^3$/tonne.

Total methane make for the period is the sum of that in the $CH_4$ drainage system (6.4 $m^3$/tonne) and that in the ventilation air (6.8 $m^3$/tonne) - ie. 13.2 $m^3$/tonne.

# CHAPTER 6 - CONCLUSIONS AND RECOMMENDATIONS

## 6.1 Conclusions

1. Considerable difficulty was experienced in the installation and commissioning of the Conspec System. MODEM tuning and balancing of signals from multiple outstations was a critical problem. Operation of the system over about a 3-year period has revealed numerous deficiencies in software and equipment reliability, particularly with its high sensitivity to dust. While the Senturion 200 has performed reasonably well, the Quay 910 Graphics System has never worked properly. Efforts by the supplier to correct the problems have been inadequate and has necessitated unnecessary and difficult systems development by CBDC.

   The problems with the Conspec System probably result from the fact that it has not been developed for use in coal mines. Until such time that these problems are overcome, it is unsatisfactory and is not recommended. Given the increased emphasis at CBDC to monitor and control critical mine functions such as mine ventilation, and the poor performance of the Conspec System, CBDC management should consider abandoning it in favour of a more reliable system.

2. Mine staff have low confidence in the values displayed by the Conspec System. This has resulted from numerous instances of excessive nuisance alarms, computer crashes, difficult calibration procedures, inability to handle non-linear output, frequent communication failures, incorrect graph scaling, the computer continuing to display a value for a non-existent point, etc. Generally only the BM1 values are used reliably by mine staff.

3. The BM1 transducers work well. The J-Tec's suffer from being very sensitive to turbulence and display a highly variable output. Other ventilation related transducers work well except for barometric pressure. With the exception of 2 Deep Door lights and fresh water flow, the mechanical related transducers were not observed to operate properly although this may be due to the difficulty in commissioning of the outstations.

4. When operating properly, the Conspec System may be utilized for gathering data for ventilation research provided very close supervision is maintained to ensure accurate calibration of the transducers.

## 6.2 Recommendations to CBDC

1. Try to overcome the dust sensitivity problem by ensuring the computer equipment is kept in a clean environment, providing forced ventilation of filtered air to critical components, and by regular cleaning.

2. To help overcome the poor availability, acquire standby equipment that may be quickly switched on when a failure occurs. Consideration should also be given to obtaining a maintenance contract (locally if possible) to ensure rapid repairs to faulty components.

3. Develop a system to take better care of program and status disks ensuring that several accurate and complete copies are always available to specified personnel.

4. Provide more training to technical staff in the system operation and maintenance. Designate a qualified person to be in charge of all system operation. Given the heavy workload of the present staff and the necessity for thorough system management, a new position perhaps at the engineering level may be necessary.

5. Further review the criteria for displaying alarms with the objective of eliminating those which are not critical and thereby improving the operator's response to real alarms.

6. In an effort to improve the confidence in J-Tec output, adopt the alternate calibration method which can be performed by 1 person. All J-Tec's should be checked and re-calibrated weekly, if necessary. Also, to reduce the high variability of output, the J-Tec's should be modified to include a 30 second RC time constant, replaced with Sieger BA5 units, and/or a software routine obtained which will provide a moving average.

### 6.3 Recommendations to Conspec

1. Develop a data communications system that can transmit accurately over long distances and which does not require re-tuning when outstations are added or removed.

2. Provide more detailed service in the commissioning and training phases to ensure the system is operating properly.

3. Investigate the use of higher quality industrial standard components which are less sensitive to dusty conditions that are often found at coal mines.

4. Correct problems with the power supplies and battery backup.

5. Correct problems with anomalous accessor card output at low voltages, and the possible sensitivity of signal and power lines to stray signals.

6. Include displays of system status in the outstation design.

7. Correct software problems including the display of values for a non-existent point, improper graph scaling, more points in Trend Log and Shift Report, long term data storage, false accuracy of displayed values, inaccurate system clock, and the inability to alarm when the computer fails. More work is also needed on the Alarm Instruction Phrases, Equipment Stoppage Analysis, and Preventive Maintenance Work Orders software packages.

8. Design software to allow the display of a moving average of J-Tec output over selected time intervals and to allow a priority level of alarms for critical parameters such as high methane, CO, and low extraction plant suction.

# LIST OF REFERENCES

## A) MANUALS:

1. System Manual - Remote Environmental Monitoring-Lingan Colliery, by Charles Greene, August 1984.

2. No. 26 Colliery Environmental Monitoring system, by Charles Hooper, June, 1982.

3. Remote Environmental Monitoring System at Prince Mine, by Bill Pickup, March, 1987.

4. Installation Maintenance and Inspection Manual for Senturion 200 Mine Wide Monitoring System, Report No. R1083, Conspec Controls Ltd., to Mine safety and Health Administration, 1983.

5. Operators Manual (Senturion 200), Conspec Controls Ltd.

6. Intrinsically Safe Outstations, P.NOS. 831328-170, 831328-180, Installation and Maintenance Manual, Report No. R1101, Conspec Inc., May, 1984.

7. PLC Serial Interface - Technical Manual, Report No. R1094, Conspec Controls Ltd., 1983.

8. Accessors and Accessor Trunk - Engineering Manual, Conspec Controls Ltd.

9. Remote I/S Trunk Drivers - P1188, P1444, P1457, P1458 Installation and Maintenance Manual, Report No. R1047, Conspec Inc., Oct., 1982.

10. Operator, Installation and Maintenance Manual for Remote I/S Trunk Driver Unit, Part No. P1188, Conspec Controls, Inc., Oct., 1982.

11. Senturion 200 System Diagnostics Manual, Report No. R1084, Conspec Controls Ltd., 1981.

12. Color Graphics Compiler - Programmer's Manual, Report No. R1087, Conspec Controls Ltd., 1982.

13. Operator's Manual - Preventive Maintenance Work Orders, Report No. R1098, Conspec Inc., March,1984.

14. Operation, Installation and Maintenance Manual for Air Flow Monitor, Part No. P1214, Report No. R1048, Conspec Controls Ltd., 1982.

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15. Operator's Manual for VA216B Air Draft Sensor, J-Tec Associates, Inc., 1981.

16. BM1 Methane Monitor - Instruction Manual, Sieger Ltd., June, 1984.

17. Cape Breton Development Corporation - No. 26 Colliery - System Description, Transmitton Ltd., 1981.

18. TM 204 Telemetry System - Operational and Maintenance Manual, Transmitton Ltd.

B) CBDC DOCUMENTS:

1. Report of Selection Committee - No. 26 Remote Monitoring and Control Project, CBDC document, Sept. 16, 1980.

2. Minutes of Meeting to Discuss E.M.R. Involvement in future Remote Monitoring Projects, CBDC document, March 30, 1982.

3. Specifications for Lingan Environmental Monitoring System, CBDC document, June, 1982.

4. Lingan Environmental Monitoring system - Systems Comparison, CBDC document, June, 1982.

5. Report of Visit to Evaluate Conspec Systems and Supplier, CBDC document, April 11, 1983.

6. Conspec Environmental Monitoring System - Technical Evaluation, CBDC document, April 15, 1983.

7. Lingan Environmental Monitoring System - Requisition Reason Sheet, CBDC document, June 22, 1983.

C) REPORTS:

1. The Application of Remote Environmental Monitoring and Control to the Cape Breton Development Corporation's No. 26 Colliery, by D. Shield, September, 1981.

2. Remote Environmental Monitoring at No. 26 Colliery, by S.K. Schwartz, November 21, 1981.

## LIST OF REFERENCES (cont'd)

3. Development of an Intrinsically Safe Mine Monitoring System for use in Coal Mines, Report No. R1081, Conspec Controls Ltd., to Supply and Services Canada, 1982.

4. Investigation into the Problems and Failures on the System Installed at Westar Mines, Conspec Controls, Ltd., February, 1985, under D.S.S. contract OSQ84-00264.

5. Mine Environment System and Sensor Performance Evaluations, by M.K. Gangal and E.D. Dainty, Canmet, MRL Division Report MRL 87-86 (OP,J), July, 1987.

## LIST OF MANUFACTURERS

1. **Conspec**
   44 Martin Ross Avenue
   Downsview, Ontario, M3J 2K8
   Telephone: (416)-661-0500

2. **Transmitton Ltd.**
   Smisby Road
   Ashby-De-La-Zouch
   Leicestershire, England, LE6 5UG
   Telephone: (05304)-5941

3. **Sieger Ltd.**
   Nuffield Estate
   Poole
   Dorset, England, BH17 7RZ
   Telephone: (0202)-676161

4. **J-Tec Associates, Inc.**
   317 7th Avenue S.W.
   Cedar Rapids
   Iowa, USA, 52401
   Telephone: (319)-366-7511

5. **Trolex Products Ltd.**
   10A Newby road
   Hazel Grove, Stockport
   Cheshire, England, SK7 5DY
   Telephone: 061-483-1435

6. **Chromalox Instruments and Controls Division**
   100 Heil-Quaker Boulevard
   Lavergne
   Tennessee, USA, 37086
   Telephone: (615)-793-7561

7. **KDG Instruments Ltd.**
   Crawley
   Sussex, England
   Telephone: (0293)-25151

8. **Bailey Controls**
   2745 Dutch Village Road, Suite 209
   Halifax, Nova Scotia

9. **Foxboro Canada ltd.**
   567 St. George St.
   Moncton, New Brunswick, E1E 2B9

## LIST OF MANUFACTURERS (cont'd)

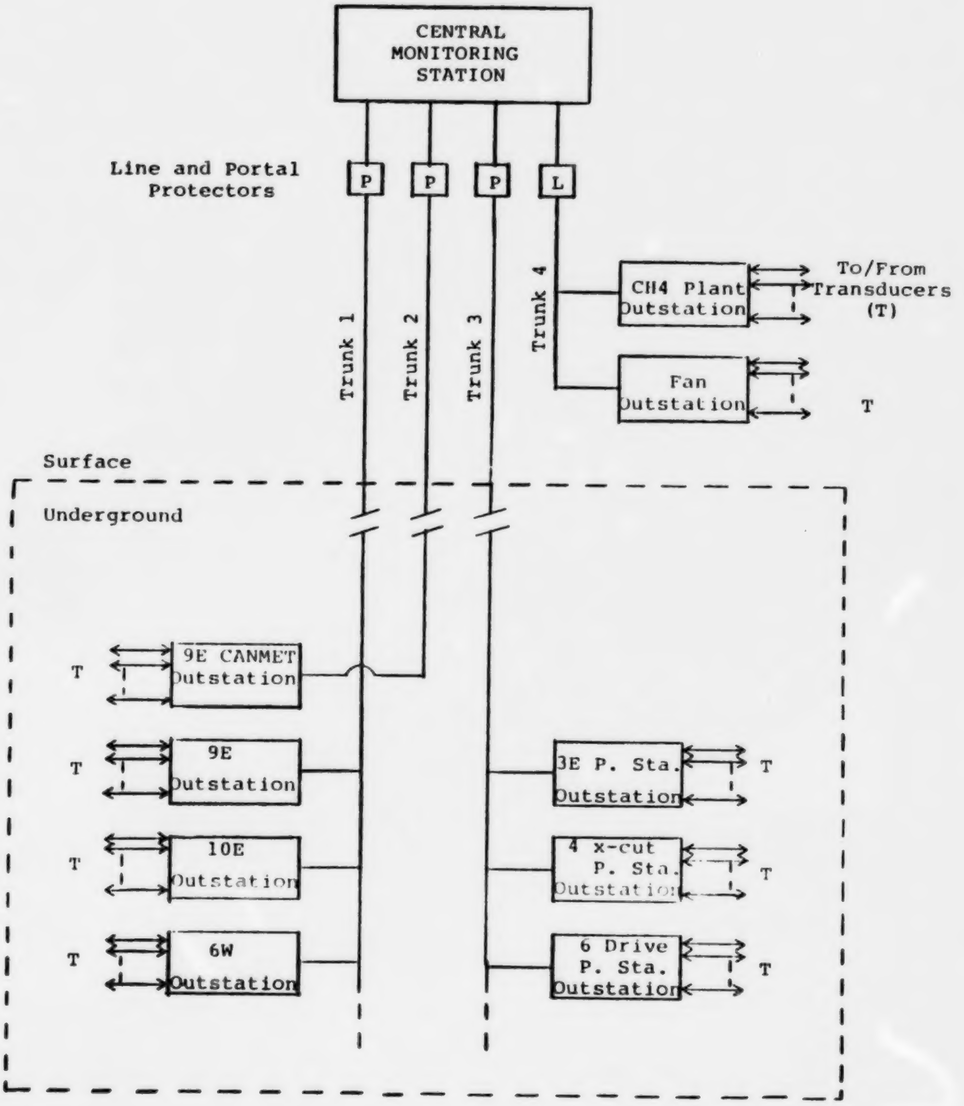
10. **N.E.I. Canada Ltd.**
    P.O. Box 967
    Sydney, Nova Scotia, B1P 6J4
    Telephone: (902)-564-5592

11. **John Davis & Son (Derby) Ltd.**
    P.O. Box 38
    Alfreton Road
    Derby, England, DE2 4AB
    Telephone: 41671

12. **First Inertia Switch**
    Harding Lane
    Hartley, Wintey
    Hants Co., England RG27

# Figures

Figure 1: Schematic Layout of Lingan Monitoring System


CENTRAL MONITORING STATION
Line and Portal Protectors
P
P
P
L
Trunk 1
Trunk 2
Trunk 3
Trunk 4
CH4 Plant Outstation
To/From Transducers (T)
Fan Outstation
T
Surface
Underground
T
9E CANMET Outstation
T
9E Outstation
T
10E Outstation
T
6W Outstation
3E P. Sta. Outstation
T
4 x-cut P. Sta. Outstation
T
6 Drive P. Sta. Outstation
T

**CAPE BRETON DEVELOPMENT CORPORATION** | **SOCIETE DE DÉVELOPPEMENT DU CAP-BRETON**

| | |
|---|---|
| PROJECT OR LOCATION | CONSPEC REMOTE MONITORING STUDY |
| TITLE | SCHEMATIC LAYOUT OF LINGAN MONITORING SYSTEM |
| Scale | N.A. |

Figure 2: Schematic Layout of Central Monitoring Station

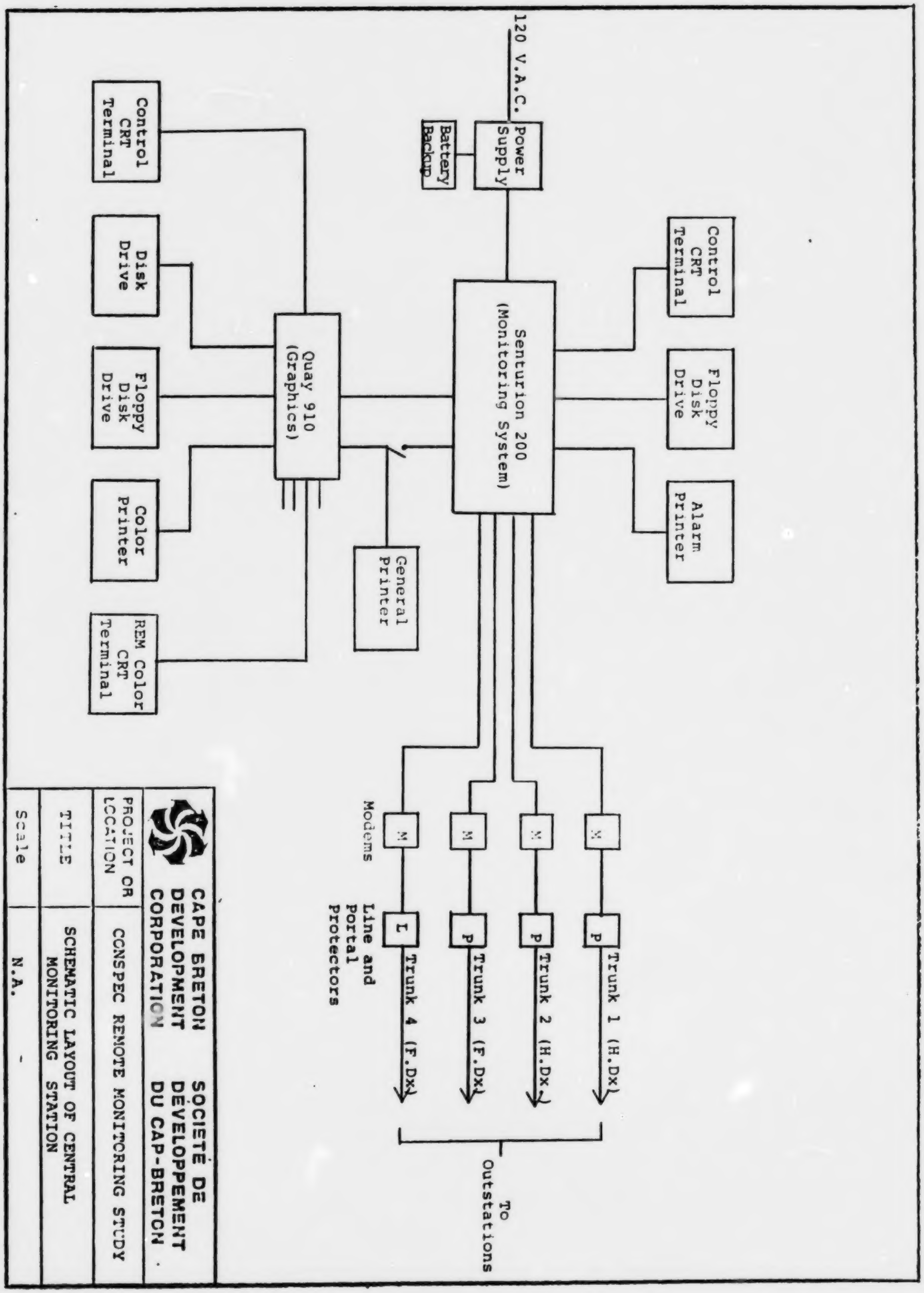

120 V.A.C.
Power Supply
Battery Backup
Control CRT Terminal
Floppy Disk Drive
Alarm Printer
Senturion 200 (Monitoring System)
Quay 910 (Graphics)
Control CRT Terminal
Disk Drive
Floppy Disk Drive
Color Printer
REM Color CRT Terminal
General Printer
M
M
M
M
Modems
P
P
P
L
Line and Portal Protectors
Trunk 1 (H.Dx)
Trunk 2 (H.Dx)
Trunk 3 (F.Dx)
Trunk 4 (F.Dx)
To Outstations
CAPE BRETON DEVELOPMENT CORPORATION
SOCIÉTÉ DE DÉVELOPPEMENT DU CAP-BRETON
PROJECT OR LOCATION
CONSPEC REMOTE MONITORING STUDY
TITLE
SCHEMATIC LAYOUT OF CENTRAL MONITORING STATION
Scale
N.A.

Figure 3: Schematic Layout of Wall Outstation

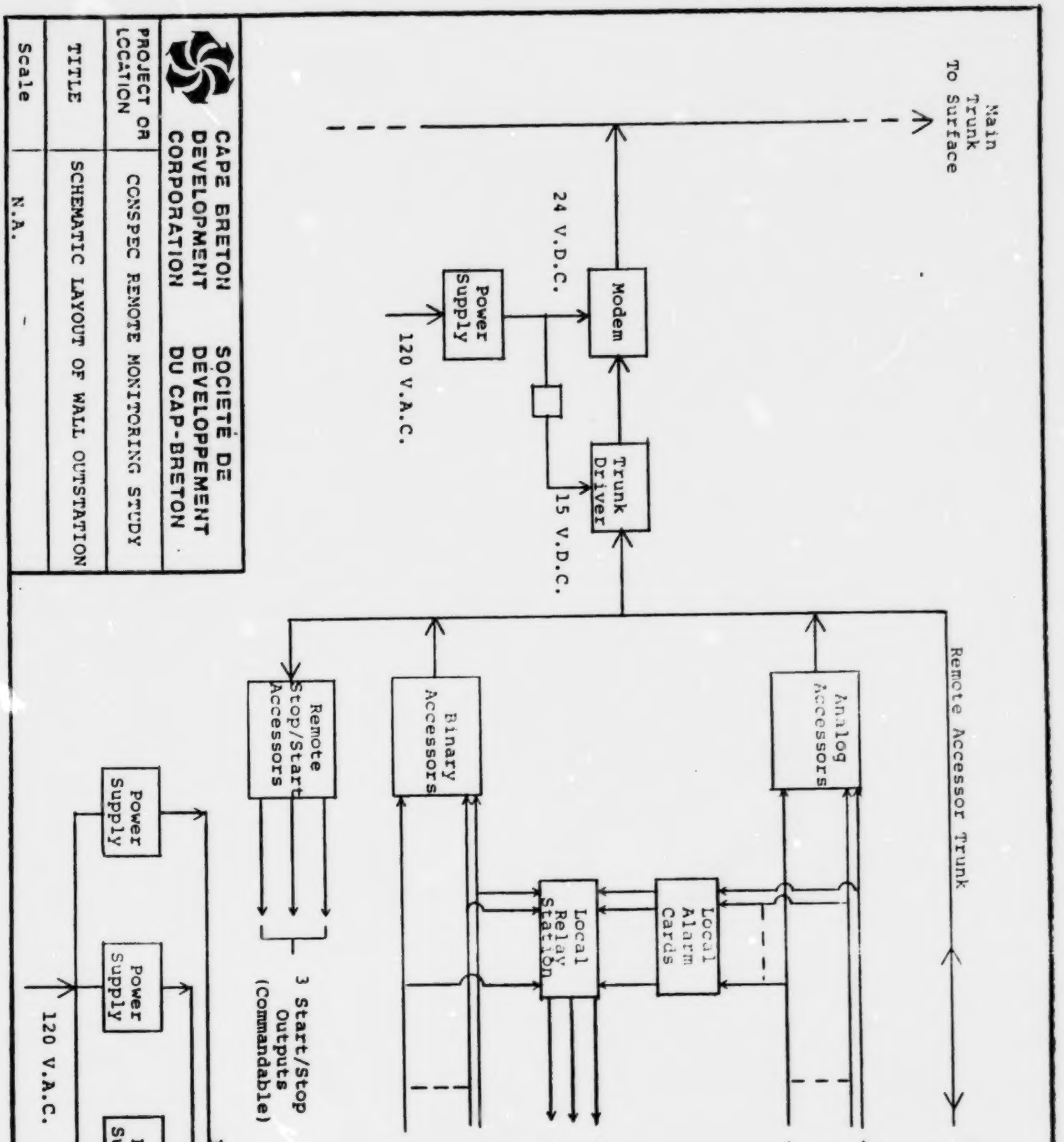
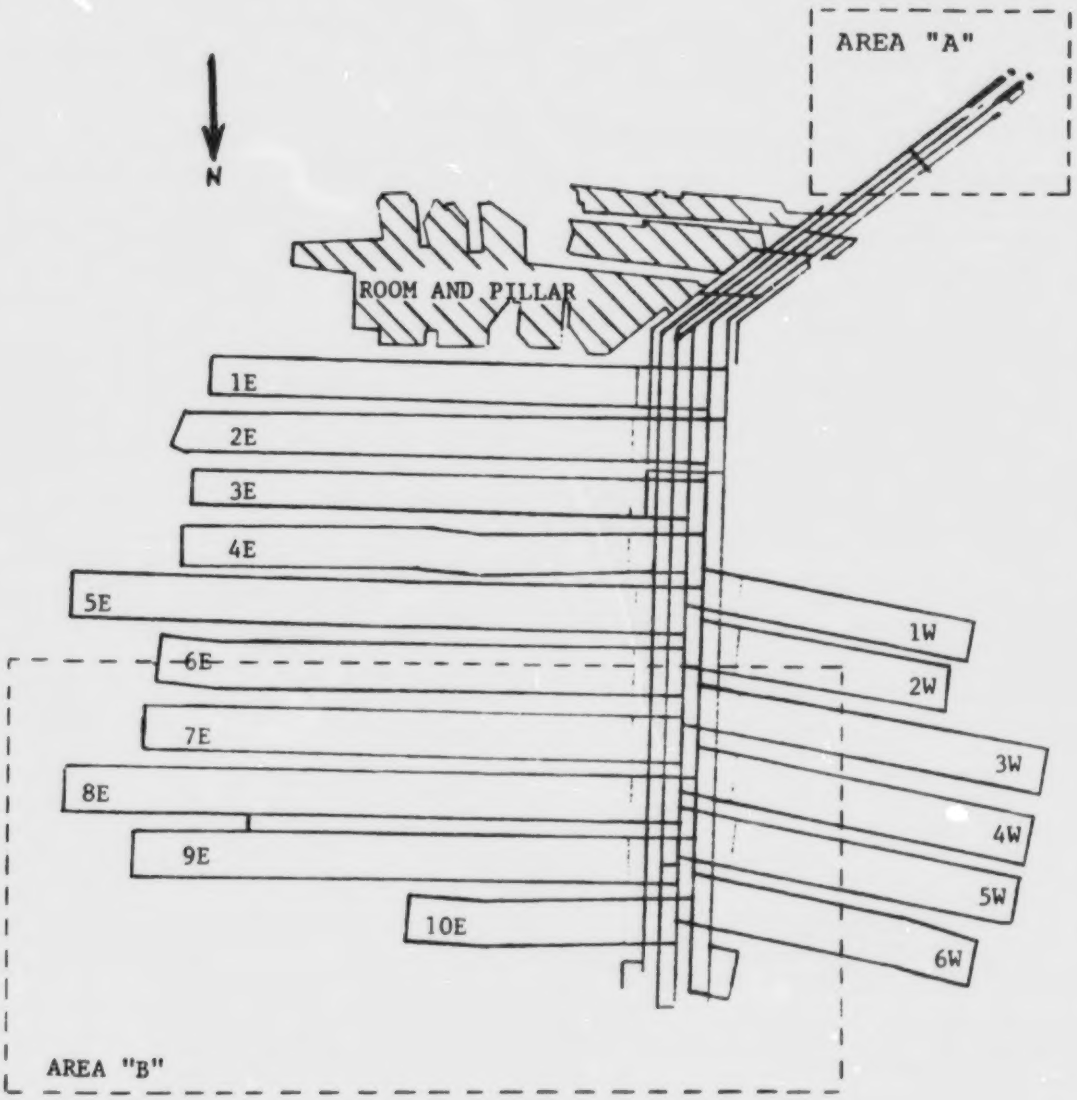

Main Trunk To Surface
Modem
Trunk Driver
Power Supply
24 V.D.C.
15 V.D.C.
120 V.A.C.
Remote Accessor Trunk
Analog Accessors
Binary Accessors
Remote Stop/Start Accessors
Local Alarm Cards
Local Relay Station
To/From Transducers And Accessors
To 8 Analog Accessors
To 3 Contacts:
- Indicator Lights
- Local Trip
- Local Start/Stop
To 10 Binary Inputs
3 Start/Stop Outputs (Commandable)
Power Supply
Power Supply
Power Supply
120 V.A.C.
14 V.D.C.
To Transducers
CAPE BRETON DEVELOPMENT CORPORATION
SOCIETÉ DE DEVELOPPEMENT DU CAP-BRETON
PROJECT OR LOCATION
CONSPEC REMOTE MONITORING STUDY
TITLE
SCHEMATIC LAYOUT OF WALL OUTSTATION
Scale
N.A.

Figure 4: Index Plan of Lingan Mine

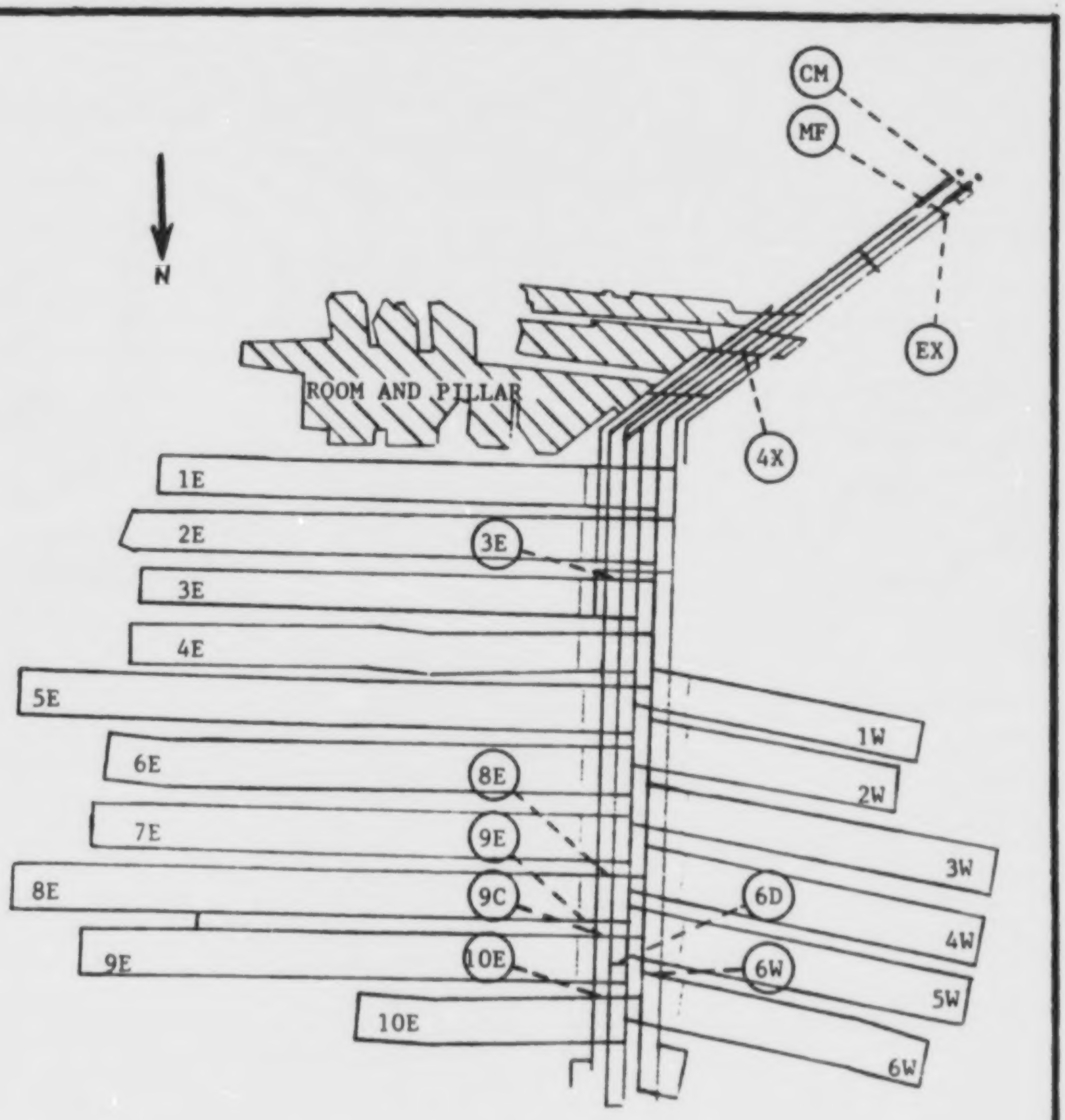

AREA "A"
N
ROOM AND PILLAR
1E
2E
3E
4E
5E
6E
7E
8E
9E
10E
1W
2W
3W
4W
5W
6W
AREA "B"

**NOTE:** For details of Area "A" see Fig. 6
For Area "B" see Figs. 8 and 9

**CAPE BRETON DEVELOPMENT CORPORATION**
**SOCIÉTÉ DE DÉVELOPPEMENT DU CAP-BRETON**

| | |
|---|---|
| PROJECT OR LOCATION | CONSPEC REMOTE MONITORING STUDY |
| TITLE | Index Map |
| Scale | Approx. 2 in. = 1 mile |

Figure 5: Outstations and Central Monitoring Station-Location Plan


CM
MF
N
EX
ROOM AND PILLAR
4X
1E
2E
3E
3E
4E
5E
1W
6E
8E
2W
7E
9E
3W
8E
9C
6D
4W
9E
10E
6W
5W
10E
6W

| LOCATIONS | SYMBOL |
|---|---|
| CENTRAL MONITORING STATION | CM |
| MAIN FAN OUTSTATION | MF |
| EXTRACTION PLANT OUTSTATION | EP |
| 4 X-CUT PUMP OUTSTATION | 4X |
| 3 EAST PUMP OUTSTATION | 3E |
| 6 DRIVE PUMP OUTSTATION | 6D |
| 6 WEST LONGWALL OUTSTATION | 6W |
| 8 EAST LONGWALL OUTSTATION | 8E |
| 9 EAST LONGWALL OUTSTATION | 9E |
| 9 EAST CANMET OUTSTATION | 9C |
| 10 EAST LONGWALL OUTSTATION | 10E |

| | |
|---|---|
| CAPE BRETON<br>DEVELOPMENT<br>CORPORATION | SOCIETE DE<br>DEVELOPPEMENT<br>DU CAP-BRETON |
| PROJECT OR LOCATION | CONSPEC REMOTE MONITORING STUDY |
| TITLE | Conspec Outstations and Central Monitoring Station Locations |
| Scale | approx. 2 in. = 1 mile |

Figure 6: Surface Transducer Locations

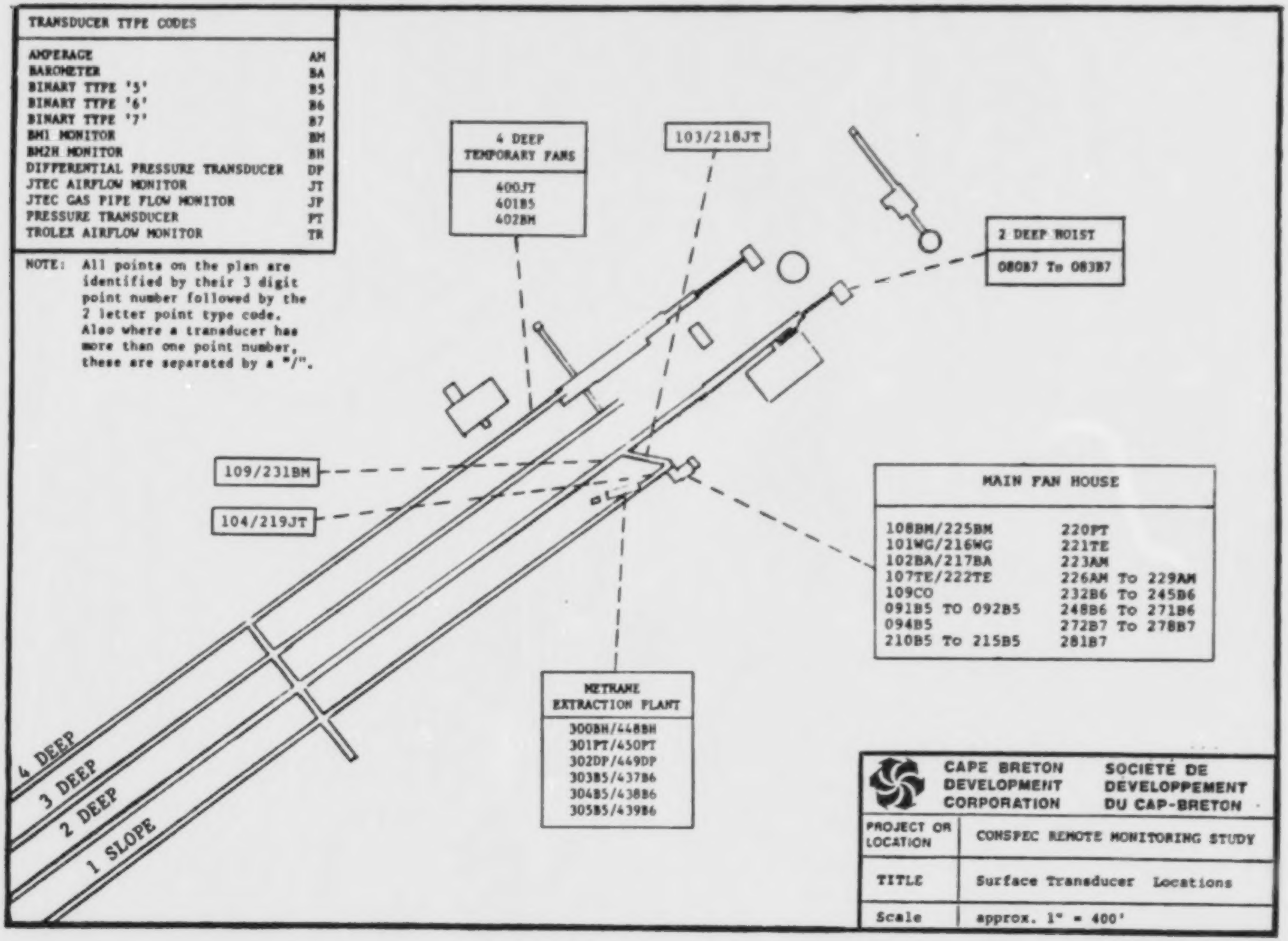
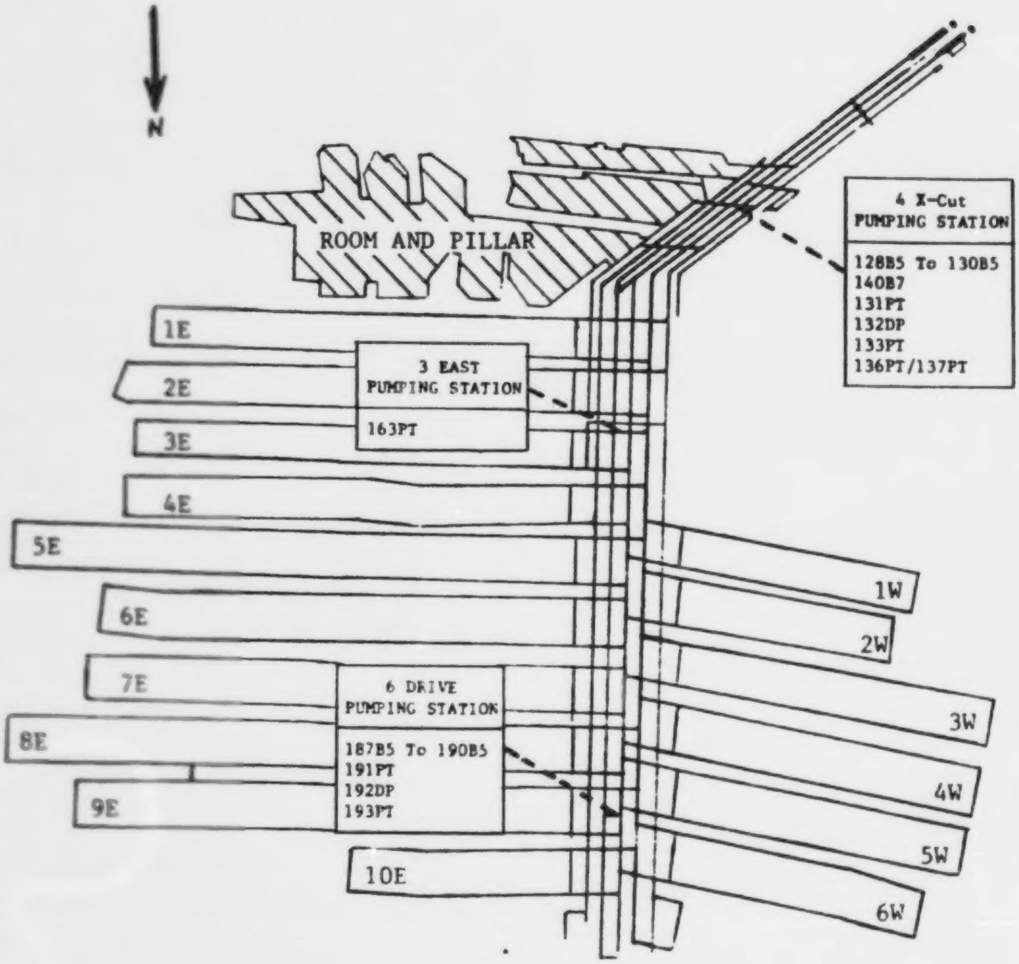

TRANSDUCER TYPE CODES
AMPERAGE AM
BAROMETER BA
BINARY TYPE '5' B5
BINARY TYPE '6' B6
BINARY TYPE '7' B7
BM1 MONITOR BM
BM2H MONITOR BH
DIFFERENTIAL PRESSURE TRANSDUCER DP
JTEC AIRFLOW MONITOR JT
JTEC GAS PIPE FLOW MONITOR JP
PRESSURE TRANSDUCER PT
TROLEX AIRFLOW MONITOR TR
NOTE: All points on the plan are identified by their 3 digit point number followed by the 2 letter point type code. Also where a transducer has more than one point number, these are separated by a "/".
4 DEEP TEMPORARY FANS
400JT
401B5
402BM
103/218JT
2 DEEP HOIST
080B7 To 083B7
109/231BM
104/219JT
MAIN FAN HOUSE
108BM/225BM
101WG/216WG
102BA/217BA
107TE/222TE
109CO
091B5 TO 092B5
094B5
210B5 To 215B5
220PT
221TE
223AM
226AM To 229AM
232B6 To 245B6
248B6 To 271B6
272B7 To 278B7
281B7
METHANE EXTRACTION PLANT
300BH/448BH
301PT/450PT
302DP/449DP
303B5/437B6
304B5/438B6
305B5/439B6
4 DEEP
3 DEEP
2 DEEP
1 SLOPE
CAPE BRETON DEVELOPMENT CORPORATION
SOCIETE DE DEVELOPPEMENT DU CAP-BRETON
PROJECT OR LOCATION
CONSPEC REMOTE MONITORING STUDY
TITLE
Surface Transducer Locations
Scale
approx. 1" = 400'

Figure 7: Pump Station Transducer Locations


N
ROOM AND PILLAR
4 X-Cut PUMPING STATION
128B5 To 130B5
140B7
131PT
132DP
133PT
136PT/137PT
3 EAST PUMPING STATION
163PT
6 DRIVE PUMPING STATION
187B5 To 190B5
191PT
192DP
193PT
1E
2E
3E
4E
5E
6E
7E
8E
9E
10E
1W
2W
3W
4W
5W
6W

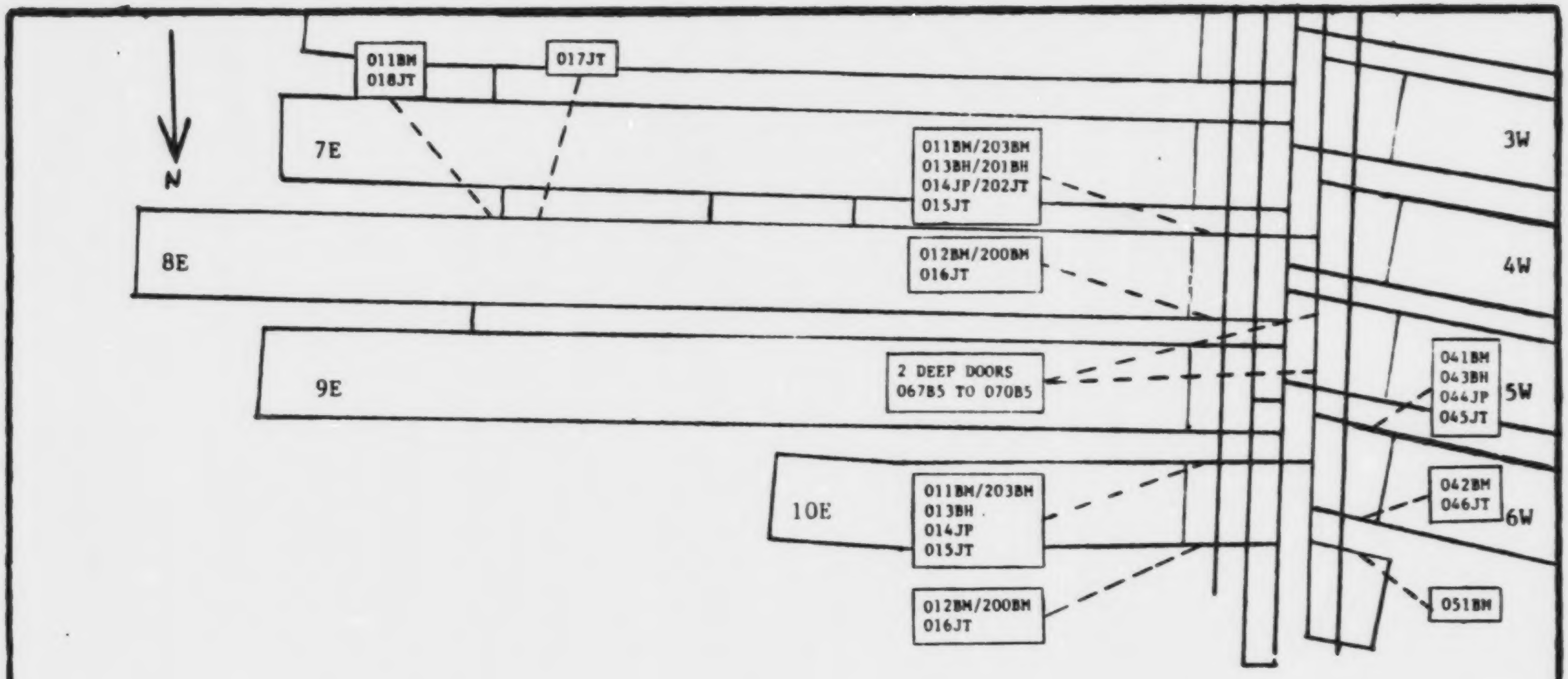
**TRANSDUCER TYPE CODES**

| | |
|---|---|
| Binary Type '5' | B5 |
| Binary Type '7' | B7 |
| Pressure | PT |
| Differential Pressure | DP |

e.g. 191 PT is point 191
- pressure transducer

| CAPE BRETON DEVELOPMENT CORPORATION | SOCIETE DE DEVELOPPEMENT DU CAP-BRETON |
|---|---|
| PROJECT OR LOCATION | CONSPEC REMOTE MONITORING STUDY |
| TITLE | Pump Station Transducers |
| Scale | approx. 2 in. = 1 mile |

Figure 8: 6 West, 10 East and 2 Deep Doors - Transducer Locations

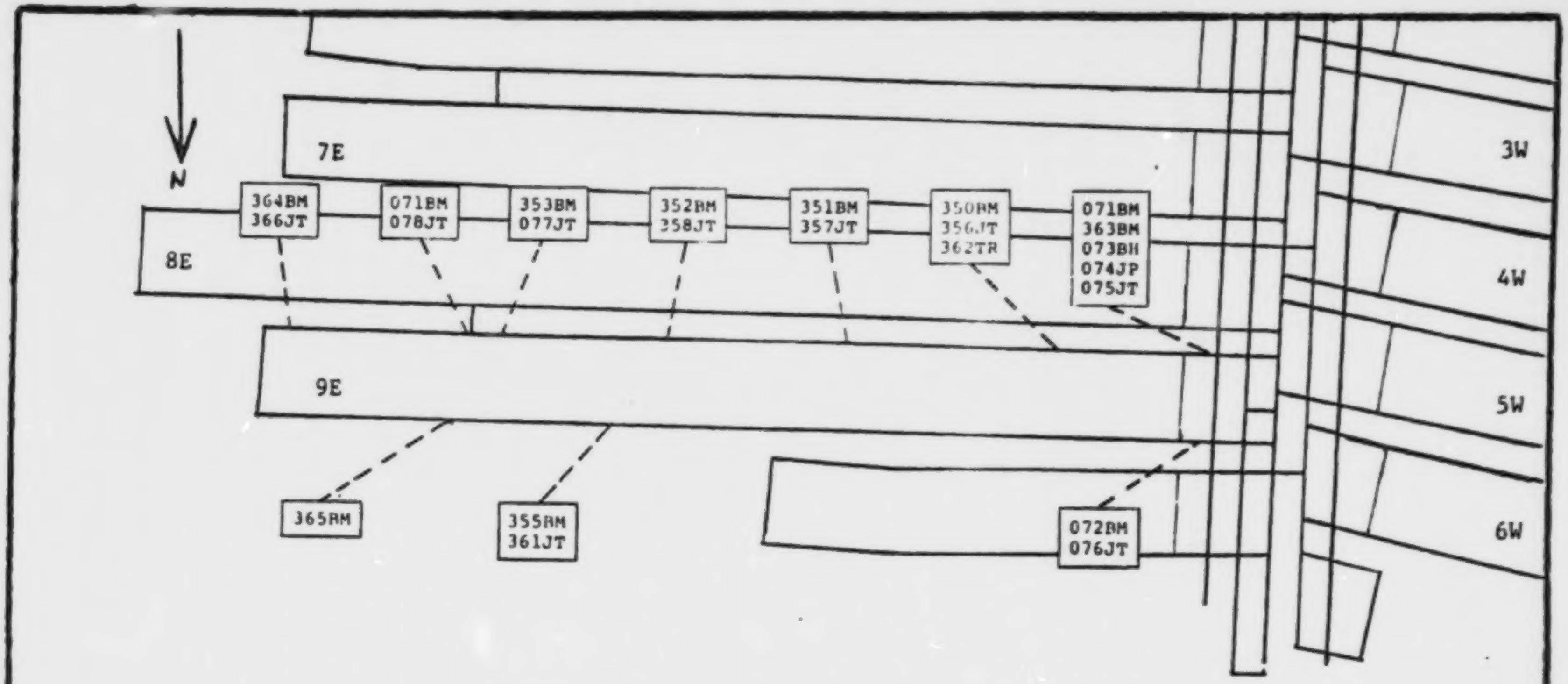

N
7E
8E
9E
10E
3W
4W
5W
6W
011BM
018JT
017JT
011BM/203BM
013BH/201BH
014JP/202JT
015JT
012BM/200BM
016JT
2 DEEP DOORS
067B5 TO 070B5
011BM/203BM
013BH
014JP
015JT
012BM/200BM
016JT
041BM
043BH
044JP
045JT
042BM
046JT
051BM

| TRANSDUCER TYPE CODES | |
|---|---|
| AMPERAGE | AM |
| BAROMETER | BA |
| BINARY TYPE '5' | B5 |
| BINARY TYPE '6' | B6 |
| BINARY TYPE '7' | B7 |
| BM1 MONITOR | BM |
| BM2H MONITOR | BH |
| DIFFERENTIAL PRESSURE TRANSDUCER | DP |
| JTEC AIRFLOW MONITOR | JT |
| JTEC GAS PIPE FLOW MONITOR | JP |
| PRESSURE TRANSDUCER | PT |
| TROLEX AIRFLOW MONITOR | TR |

NOTE: All points on the plan are identified by their 3 digit point number followed by the 2 letter point type code. Also where a transducer has more than one point number, these are separated by a "/".

| CAPE BRETON DEVELOPMENT CORPORATION | SOCIÉTÉ DE DÉVELOPPEMENT DU CAP-BRETON |
|---|---|
| PROJECT OR LOCATION | CONSPEC REMOTE MONITORING STUDY |
| TITLE | 6 West, 8 East, 10 East and 2 Deep Doors Transducers |
| Scale | Approx. 1 in. = 1370 ft. |

Figure 9: 9 East Longwall and Canmet Study - Transducer Locations


N
7E
8E
9E
3W
4W
5W
6W
364BM
366JT
071BM
078JT
353BM
077JT
352BM
358JT
351BM
357JT
350BM
356JT
362TR
071BM
363BM
073BH
074JP
075JT
365BM
355BM
361JT
072BM
076JT

| TRANSDUCER TYPE CODES | |
|---|---|
| AMPERAGE | AM |
| BAROMETER | BA |
| BINARY TYPE '5' | B5 |
| BINARY TYPE '6' | B6 |
| BINARY TYPE '7' | B7 |
| BM1 MONITOR | BM |
| BM2H MONITOR | BH |
| DIFFERENTIAL PRESSURE TRANSDUCER | DP |
| JTEC AIRFLOW MONITOR | JT |
| JTEC GAS PIPE FLOW MONITOR | JP |
| PRESSURE TRANSDUCER | PT |
| TROLEX AIRFLOW MONITOR | TR |

NOTE: All points on the plan are identified by their 3 digit point number followed by the 2 letter point type code. Also where a transducer has more than one point number, these are separated by a "/".

| CAPE BRETON DEVELOPMENT CORPORATION | SOCIETE DE DEVELOPPEMENT DU CAP-BRETON |
|---|---|
| PROJECT OR LOCATION | CONSPEC REMOTE MONITORING STUDY |
| TITLE | 9 East Longwall and 9 East Canmet Study Transducers |
| Scale | Approx. 1 in. = 1370 ft. |

Figure 10: Schematic Layout of Senturion Control Terminal Screen

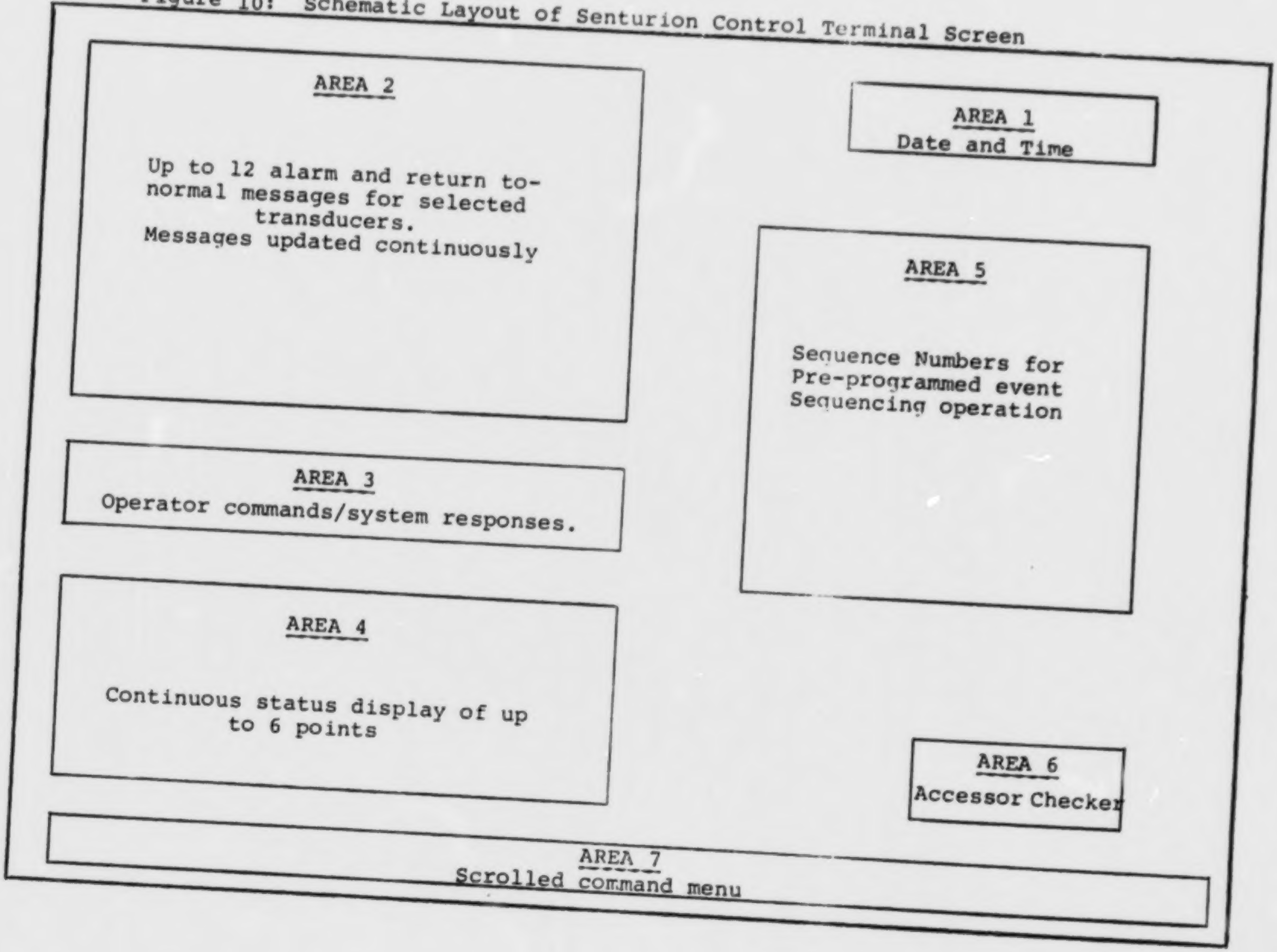
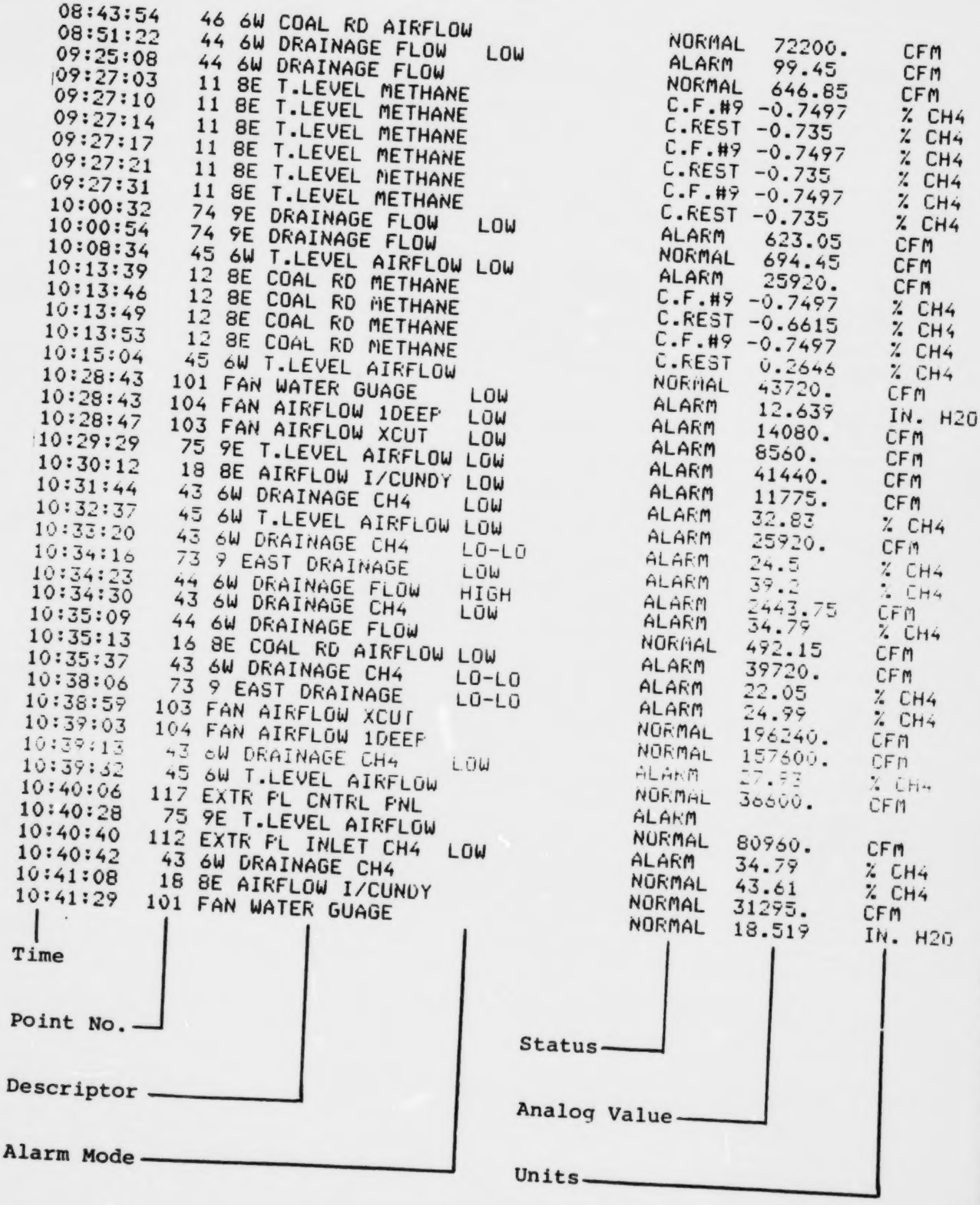

AREA 2
Up to 12 alarm and return to-normal messages for selected transducers.
Messages updated continuously
AREA 1
Date and Time
AREA 5
Sequence Numbers for Pre-programmed event Sequencing operation
AREA 3
Operator commands/system responses.
AREA 4
Continuous status display of up to 6 points
AREA 6
Accessor Checker
AREA 7
Scrolled command menu

Figure 11: Portion of An Event Log



```
08:43:54    46 6W COAL RD AIRFLOW
08:51:22    44 6W DRAINAGE FLOW    LOW          NORMAL  72200.     CFM
09:25:08    44 6W DRAINAGE FLOW                 ALARM    99.45     CFM
09:27:03    11 8E T.LEVEL METHANE               NORMAL  646.85     CFM
09:27:10    11 8E T.LEVEL METHANE               C.F.#9 -0.7497     % CH4
09:27:14    11 8E T.LEVEL METHANE               C.REST -0.735      % CH4
09:27:17    11 8E T.LEVEL METHANE               C.F.#9 -0.7497     % CH4
09:27:21    11 8E T.LEVEL METHANE               C.REST -0.735      % CH4
09:27:31    11 8E T.LEVEL METHANE               C.F.#9 -0.7497     % CH4
10:00:32    74 9E DRAINAGE FLOW    LOW          C.REST -0.735      % CH4
10:00:54    74 9E DRAINAGE FLOW                 ALARM    623.05    CFM
10:08:34    45 6W T.LEVEL AIRFLOW LOW           NORMAL   694.45    CFM
10:13:39    12 8E COAL RD METHANE               ALARM    25920.    CFM
10:13:46    12 8E COAL RD METHANE               C.F.#9 -0.7497     % CH4
10:13:49    12 8E COAL RD METHANE               C.REST -0.6615     % CH4
10:13:53    12 8E COAL RD METHANE               C.F.#9 -0.7497     % CH4
10:15:04    45 6W T.LEVEL AIRFLOW               C.REST  0.2646     % CH4
10:28:43   101 FAN WATER GUAGE     LOW          NORMAL  43720.     CFM
10:28:43   104 FAN AIRFLOW 1DEEP   LOW          ALARM   12.639     IN. H20
10:28:47   103 FAN AIRFLOW XCUT    LOW          ALARM   14080.     CFM
10:29:29    75 9E T.LEVEL AIRFLOW LOW           ALARM   8560.      CFM
10:30:12    18 8E AIRFLOW I/CUNDY LOW           ALARM   41440.     CFM
10:31:44    43 6W DRAINAGE CH4     LOW          ALARM   11775.     CFM
10:32:37    45 6W T.LEVEL AIRFLOW LOW           ALARM   32.83      % CH4
10:33:20    43 6W DRAINAGE CH4     LO-LO        ALARM   25920.     CFM
10:34:16    73 9 EAST DRAINAGE     LOW          ALARM   24.5       % CH4
10:34:23    44 6W DRAINAGE FLOW    HIGH         ALARM   39.2       % CH4
10:34:30    43 6W DRAINAGE CH4     LOW          ALARM   2443.75    CFM
10:35:09    44 6W DRAINAGE FLOW                 ALARM   34.79      % CH4
10:35:13    16 8E COAL RD AIRFLOW LOW           NORMAL  492.15     CFM
10:35:37    43 6W DRAINAGE CH4     LO-LO        ALARM   39720.     CFM
10:38:06    73 9 EAST DRAINAGE     LO-LO        ALARM   22.05      % CH4
10:38:59   103 FAN AIRFLOW XCUT                 ALARM   24.99      % CH4
10:39:03   104 FAN AIRFLOW 1DEEP                NORMAL  196240.    CFM
10:39:13    43 6W DRAINAGE CH4     LOW          NORMAL  157600.    CFM
10:39:32    45 6W T.LEVEL AIRFLOW               ALARM   27.93      % CH4
10:40:06   117 EXTR PL CNTRL PNL                NORMAL  36600.     CFM
10:40:28    75 9E T.LEVEL AIRFLOW               ALARM
10:40:40   112 EXTR PL INLET CH4  LOW           NORMAL  80960.     CFM
10:40:42    43 6W DRAINAGE CH4                  ALARM   34.79      % CH4
10:41:08    18 8E AIRFLOW I/CUNDY               NORMAL  43.61      % CH4
10:41:29   101 FAN WATER GUAGE                  NORMAL  31295.     CFM
                                                NORMAL  18.519     IN. H20
```

FIG. 12: Portion Of An All Points Log

```
         Date        Time of Report
          |            |
JUL 22, 1987  08:57:55   ALL POINT LOG 4
  11 10E TLEVEL METHANE HIGH            ALARM    1.6611    % CH4
  12 10E COALRD METHANE                 C.F.#1   0.1617    % CH4
  13 10E DRAINAGE CH4                   NORMAL   90.16     % CH4
  14 10E DRAINAGE FLOW                  C.F.#9  -531.25    C.F.M.
  15 10E TLEVEL AIRFLOW                 NORMAL   58080.    C.F.M.
  16 10E BLEVEL AIRFLOW                 NORMAL   66849.    C.F.M.
  42 6 WEST BOT CH4                     C.F.#1   0.147     % CH4
  43 6W DRAINAGE CH4 %                  C.F.#1   57.33     % CH4
  44 6W DRAINAGE FLOW   LOW             C.F.#9  -162.35    C.F.M.
  45 6W T.LEVEL AIRFLOW                 C.F.#1   74770.    C.F.M.
  46 6W COAL RD AIRFLOW HIGH            C.F.#1   114460.   C.F.M.
  51 7W TOP LEVEL CH4                   C.F.#1   0.4998    % CH4
  52 7W COAL RD CH4                     C.F.#1   0.1029    % CH4
  53 7W DRAINAGE CH4                    C.F.#9  -24.99     % CH4
  54 7W DRAINAGE FLOW                   C.F.#1   63.75     C.F.M.
  55 7W T LEVEL AIRFLOW                 C.F.#1   0.00      C.F.M.
  56 7W COAL RD AIRFLOW                 C.F.#1   1.00      C.F.M.
  67 TOP DOOR CLOSE SW  CLOSE           NORMAL
  68 TOP DOOR OPEN SW   OPEN            ALARM
  69 BOT DOOR CLOSE SW  CLOSE           NORMAL
  70 BOT DOOR OPEN SW   OPEN            ALARM
  71 9E CUNDY METHANE   HIGH            ALARM    1.3965    % CH4
  72 9E COAL RD METHANE HI-HI           C.REST   0.0882    % CH4
  73 9E DRAINAGE CH4 %                  NORMAL   90.65     % CH4
  74 9E DRAINAGE FLOW   LOW             ALARM    99.45     C.F.M.
  75 9E T.LEVEL AIRFLOW                 C.REST   12100.    C.F.M.
  76 9E COAL RD AIRFLOW                 NORMAL   65153.    C.F.M.
  77 9E OUTSIDE C. AIRF                 NORMAL   19460.    C.F.M.
  78 9E INSIDE C. AIRF                  NORMAL   46113.    C.F.M.
  80 T. DOOR CLOSED DR  ON              NORMAL
  81 T. DOOR OPEN DRIVE OFF             NORMAL
  82 B. DOOR CLOSED DR  ON              NORMAL
  83 B. DOOR OPEN DRIVE OFF             NORMAL
 121 4XCUT #1MOTOR C/S  OPEN            C.REST
 122 4XCUT #1 MOTOR O/L OK              C.REST
 123 4XCUT #1 MOTOR E/L TRIP            C.F.#2
 124 4XCUT #2 MOTOR C/S CLOSE           C.F.#2
 125 4XCUT #2 MOTOR O/L OK              C.F.#2
 126 4XCUT #2 MOTOR E/L TRIP            C.F.#2

Point No.

Descriptor

Status

Analog Value

Units
```

FIG. 13: Portion of An Alarm Summary

Date

Time of Report

```
JUL 22, 1987  08:59:15   ALARM SUMMARY 4
  11 10E TLEVEL METHANE HIGH          ALARM    1.6317    % CH4
  12 10E COALRD METHANE               C.F.#1   0.1617    % CH4
  14 10E DRAINAGE FLOW                C.F.#9 -531.25     C.F.M.
  42 6 WEST BOT CH4                   C.F.#1   0.147     % CH4
  43 6W DRAINAGE CH4 %                C.F.#1   57.33     % CH4
  44 6W DRAINAGE FLOW   LOW           C.F.#9 -162.35     C.F.M.
  45 6W T.LEVEL AIRFLOW               C.F.#1   74770.    C.F.M.
  46 6W COAL RD AIRFLOW HIGH          C.F.#1   114460.   C.F.M.
  51 7W TOP LEVEL CH4                 C.F.#1   0.4998    % CH4
  52 7W COAL RD CH4                   C.F.#1   0.1029    % CH4
  53 7W DRAINAGE CH4                  C.F.#9 -24.99      % CH4
  54 7W DRAINAGE FLOW                 C.F.#1   63.75     C.F.M.
  55 7W T LEVEL AIRFLOW               C.F.#1   0.00      C.F.M.
  56 7W COAL RD AIRFLOW               C.F.#1   1.00      C.F.M.
  68 TOP DOOR OPEN SW   OPEN          ALARM
  70 BOT DOOR OPEN SW   OPEN          ALARM
  71 9E CUNDY METHANE   HIGH          ALARM    1.3965    % CH4
  74 9E DRAINAGE FLOW   LOW           ALARM    87.55     C.F.M.
 121 4XCUT #1MOTOR C/S  OPEN          C.REST
 123 4XCUT #1 MOTOR E/L TRIP          C.F.#2
 124 4XCUT #2 MOTOR C/S CLOSE         C.F.#2
 125 4XCUT #2 MOTOR O/L OK            C.F.#2
 126 4XCUT #2 MOTOR E/L TRIP          C.F.#2
 127 4XCUT #1 PUMP TEMP OK            C.F.#2
 130 4XCUT #2 PUMP VIB.  OK           C.F.#2
 131 4XCUT PUMP D.PRESS HIGH          ALARM    399.81     P.S.I.
 133 4XCUT PUMP W.LEVEL HIGH          C.REST   3.6738     METRES
 134 4XCUT #1 PMP MOTOR               C.F.#9 -60.18        AMPS
 135 4XCUT #2 PMP MOTOR HIGH          C.F.#9 -60.18        AMPS
 136 FRESH WATER FLOW   LOW           C.F.#1 -36.12       G.P.M.
 137 WEEKEND WATER FLOW HIGH          C.F.#9 -34.4        G.P.M.
 187 6 D.PMP #1PMP TEMP OK            C.REST
 192 6DRIVE PUMP W.FLOW               ALARM  -500.
 194 6DRIVE #1PMP MOTOR LOW           ALARM  -60.18        AMPS
 205 AUTO START 3 PUMP  STOP          C.F.#1
 206 AUTO STOP 3 PUMP   RUN           C.F.#0
 210 FIRE IN FAN HOUSE   OFF          C.REST
 217 BAROMETER          HIGH          ALARM    31.69     IN HG
 224 FAN CARBON MONOX                 C.F.#9 -12.495       PPM
 228 NO 3 COMP MTR CURR LOW           C.F.#9 -74.97        AMPS
```

Point No.

Descriptor

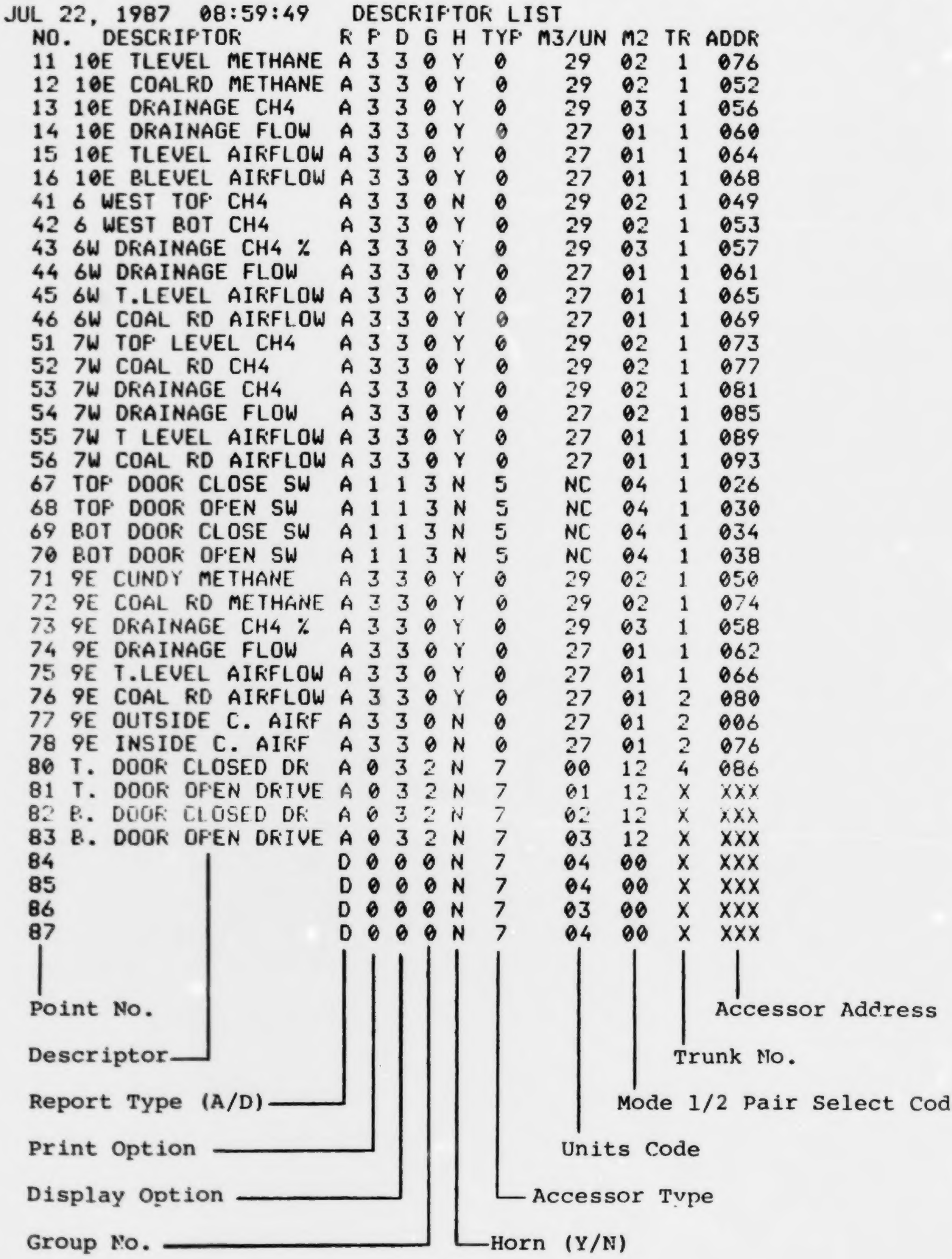
Alarm Mode

Status

Analog Value

Units

FIG. 14: Portion Of A Descriptor List



```
JUL 22, 1987  08:59:49   DESCRIPTOR LIST
  NO.  DESCRIPTOR          R P D G H TYP  M3/UN  M2  TR  ADDR
  11 10E TLEVEL METHANE    A 3 3 0 Y  0     29   02   1   076
  12 10E COALRD METHANE    A 3 3 0 Y  0     29   02   1   052
  13 10E DRAINAGE CH4      A 3 3 0 Y  0     29   03   1   056
  14 10E DRAINAGE FLOW     A 3 3 0 Y  0     27   01   1   060
  15 10E TLEVEL AIRFLOW    A 3 3 0 Y  0     27   01   1   064
  16 10E BLEVEL AIRFLOW    A 3 3 0 Y  0     27   01   1   068
  41 6 WEST TOP CH4        A 3 3 0 N  0     29   02   1   049
  42 6 WEST BOT CH4        A 3 3 0 Y  0     29   02   1   053
  43 6W DRAINAGE CH4 %     A 3 3 0 Y  0     29   03   1   057
  44 6W DRAINAGE FLOW      A 3 3 0 Y  0     27   01   1   061
  45 6W T.LEVEL AIRFLOW    A 3 3 0 Y  0     27   01   1   065
  46 6W COAL RD AIRFLOW    A 3 3 0 Y  0     27   01   1   069
  51 7W TOP LEVEL CH4      A 3 3 0 Y  0     29   02   1   073
  52 7W COAL RD CH4        A 3 3 0 Y  0     29   02   1   077
  53 7W DRAINAGE CH4       A 3 3 0 Y  0     29   02   1   081
  54 7W DRAINAGE FLOW      A 3 3 0 Y  0     27   02   1   085
  55 7W T LEVEL AIRFLOW    A 3 3 0 Y  0     27   01   1   089
  56 7W COAL RD AIRFLOW    A 3 3 0 Y  0     27   01   1   093
  67 TOP DOOR CLOSE SW     A 1 1 3 N  5     NC   04   1   026
  68 TOP DOOR OPEN SW      A 1 1 3 N  5     NC   04   1   030
  69 BOT DOOR CLOSE SW     A 1 1 3 N  5     NC   04   1   034
  70 BOT DOOR OPEN SW      A 1 1 3 N  5     NC   04   1   038
  71 9E CUNDY METHANE      A 3 3 0 Y  0     29   02   1   050
  72 9E COAL RD METHANE    A 3 3 0 Y  0     29   02   1   074
  73 9E DRAINAGE CH4 %     A 3 3 0 Y  0     29   03   1   058
  74 9E DRAINAGE FLOW      A 3 3 0 Y  0     27   01   1   062
  75 9E T.LEVEL AIRFLOW    A 3 3 0 Y  0     27   01   1   066
  76 9E COAL RD AIRFLOW    A 3 3 0 Y  0     27   01   2   080
  77 9E OUTSIDE C. AIRF    A 3 3 0 N  0     27   01   2   006
  78 9E INSIDE C. AIRF     A 3 3 0 N  0     27   01   2   076
  80 T. DOOR CLOSED DR     A 0 3 2 N  7     00   12   4   086
  81 T. DOOR OPEN DRIVE    A 0 3 2 N  7     01   12   X   XXX
  82 B. DOOR CLOSED DR     A 0 3 2 N  7     02   12   X   XXX
  83 B. DOOR OPEN DRIVE    A 0 3 2 N  7     03   12   X   XXX
  84                       D 0 0 0 N  7     04   00   X   XXX
  85                       D 0 0 0 N  7     04   00   X   XXX
  86                       D 0 0 0 N  7     03   00   X   XXX
  87                       D 0 0 0 N  7     04   00   X   XXX
```

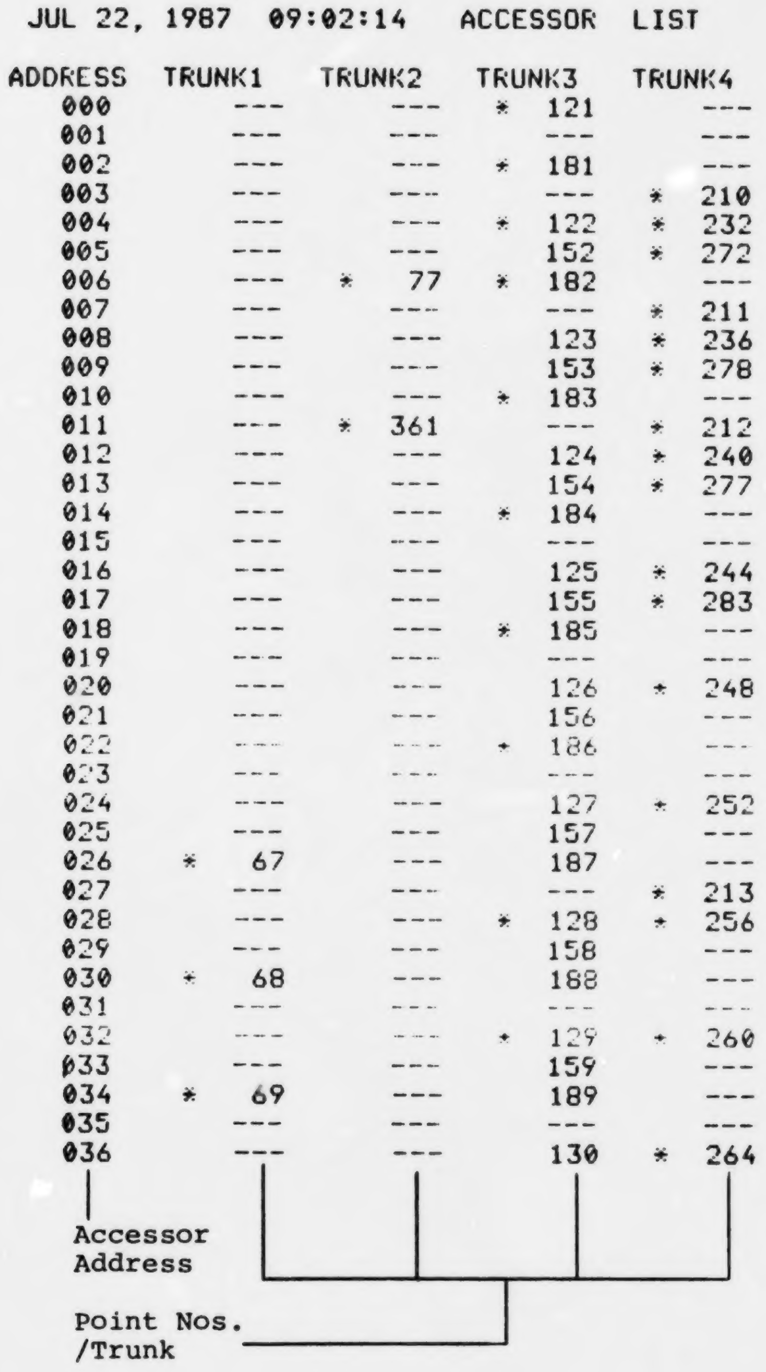
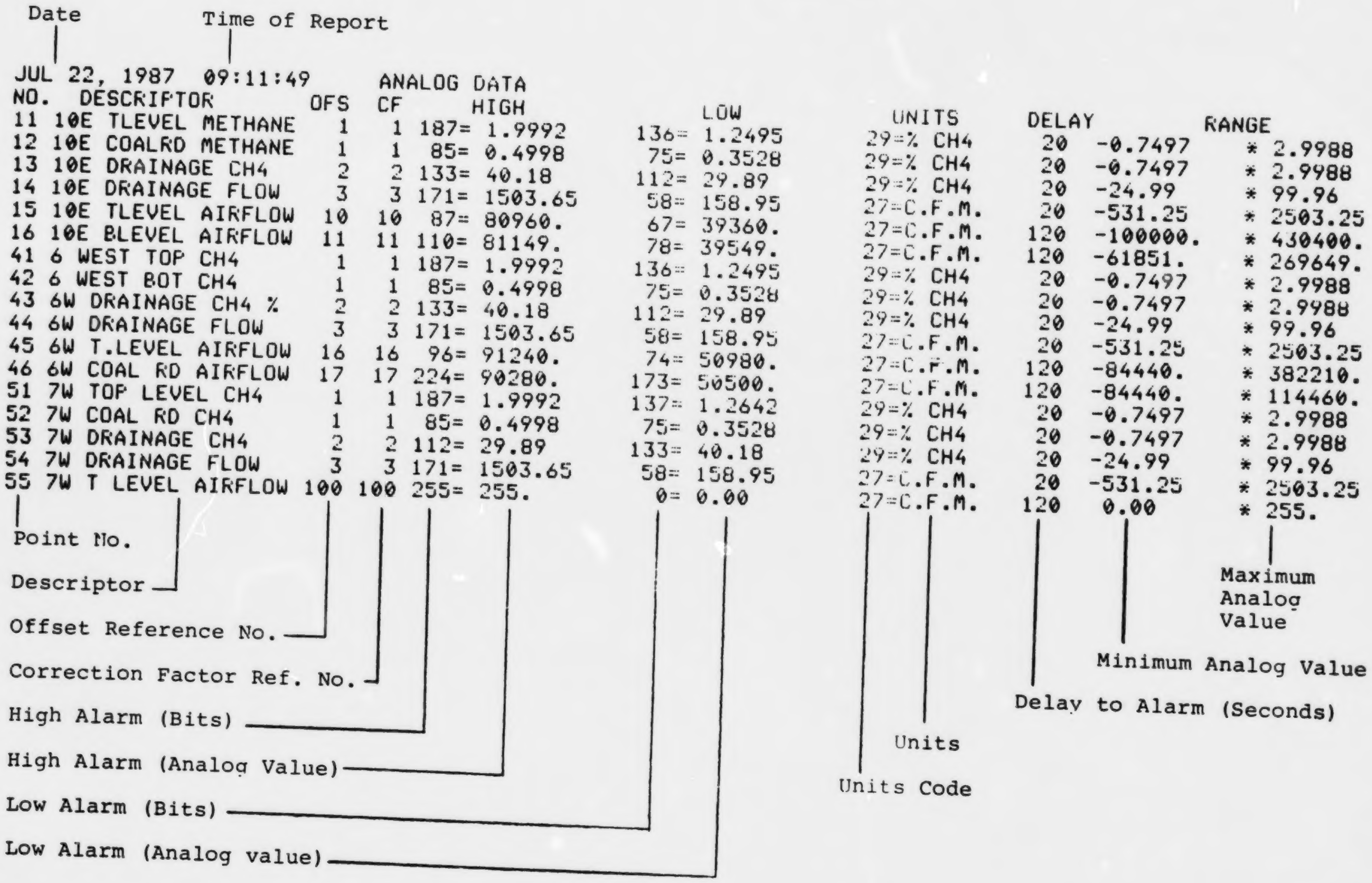


FIG. 15: Portion Of An Accessor List

```
JUL 22, 1987  09:02:14   ACCESSOR  LIST

ADDRESS  TRUNK1    TRUNK2    TRUNK3    TRUNK4
  000         ---       ---    *  121       ---
  001         ---       ---       ---       ---
  002         ---       ---    *  181       ---
  003         ---       ---       ---    *  210
  004         ---       ---    *  122    *  232
  005         ---       ---       152    *  272
  006         ---    *   77    *  182       ---
  007         ---       ---       ---    *  211
  008         ---       ---       123    *  236
  009         ---       ---       153    *  278
  010         ---       ---    *  183       ---
  011         ---    *  361       ---    *  212
  012         ---       ---       124    *  240
  013         ---       ---       154    *  277
  014         ---       ---    *  184       ---
  015         ---       ---       ---       ---
  016         ---       ---       125    *  244
  017         ---       ---       155    *  283
  018         ---       ---    *  185       ---
  019         ---       ---       ---       ---
  020         ---       ---       126    *  248
  021         ---       ---       156       ---
  022         ---       ---    *  186       ---
  023         ---       ---       ---       ---
  024         ---       ---       127    *  252
  025         ---       ---       157       ---
  026      *   67       ---       187       ---
  027         ---       ---       ---    *  213
  028         ---       ---    *  128    *  256
  029         ---       ---       158       ---
  030      *   68       ---       188       ---
  031         ---       ---       ---       ---
  032         ---       ---    *  129    *  260
  033         ---       ---       159       ---
  034      *   69       ---       189       ---
  035         ---       ---       ---       ---
  036         ---       ---       130    *  264
```

FIG.16: Portion Of An Analog Data Report



```
JUL 22, 1987  09:11:49       ANALOG DATA
NO.  DESCRIPTOR          OFS   CF     HIGH              LOW            UNITS       DELAY                RANGE
11 10E TLEVEL METHANE      1    1 187= 1.9992       136= 1.2495      29=% CH4       20   -0.7497      * 2.9988
12 10E COALRD METHANE      1    1  85= 0.4998        75= 0.3528      29=% CH4       20   -0.7497      * 2.9988
13 10E DRAINAGE CH4        2    2 133= 40.18        112= 29.89       29=% CH4       20   -24.99       * 99.96
14 10E DRAINAGE FLOW       3    3 171= 1503.65       58= 158.95      27=C.F.M.      20   -531.25      * 2503.25
15 10E TLEVEL AIRFLOW     10   10  87= 80960.        67= 39360.      27=C.F.M.      20   -531.25      * 2503.25
16 10E BLEVEL AIRFLOW     11   11 110= 81149.        78= 39549.      27=C.F.M.     120   -100000.     * 430400.
41 6 WEST TOP CH4          1    1 187= 1.9992       136= 1.2495      27=C.F.M.     120   -61851.      * 269649.
42 6 WEST BOT CH4          1    1  85= 0.4998        75= 0.3528      29=% CH4       20   -0.7497      * 2.9988
43 6W DRAINAGE CH4 %       2    2 133= 40.18        112= 29.89       29=% CH4       20   -0.7497      * 2.9988
44 6W DRAINAGE FLOW        3    3 171= 1503.65       58= 158.95      29=% CH4       20   -24.99       * 99.96
45 6W T.LEVEL AIRFLOW     16   16  96= 91240.        74= 50980.      27=C.F.M.      20   -531.25      * 2503.25
46 6W COAL RD AIRFLOW     17   17 224= 90280.       173= 50500.      27=C.F.M.     120   -84440.      * 382210.
51 7W TOP LEVEL CH4        1    1 187= 1.9992       137= 1.2642      27=C.F.M.     120   -84440.      * 114460.
52 7W COAL RD CH4          1    1  85= 0.4998        75= 0.3528      29=% CH4       20   -0.7497      * 2.9988
53 7W DRAINAGE CH4         2    2 112= 29.89        133= 40.18       29=% CH4       20   -0.7497      * 2.9988
54 7W DRAINAGE FLOW        3    3 171= 1503.65       58= 158.95      29=% CH4       20   -24.99       * 99.96
55 7W T LEVEL AIRFLOW    100  100 255= 255.           0= 0.00        27=C.F.M.      20   -531.25      * 2503.25
                                                                     27=C.F.M.     120    0.00        * 255.
```

Date
Time of Report
Point No.
Descriptor
Offset Reference No.
Correction Factor Ref. No.
High Alarm (Bits)
High Alarm (Analog Value)
Low Alarm (Bits)
Low Alarm (Analog value)
Units Code
Units
Delay to Alarm (Seconds)
Minimum Analog Value
Maximum Analog Value

FIG. 17: Portion Of A Correction Factor - Offset Table

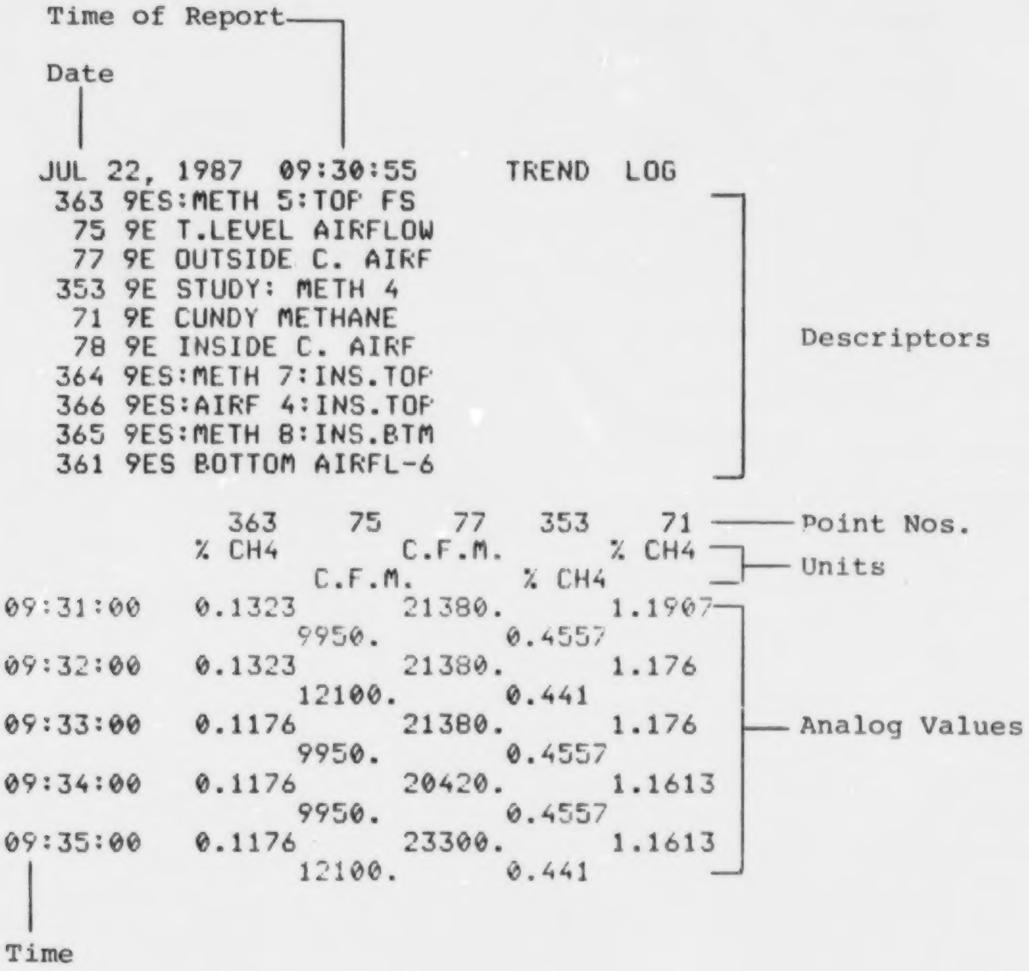
```
JUL 22, 1987  09:10:41     CF-OFS TABLE R
REF.NO. M*D.DDESX=CORR.FACTOR    SD.DDDDESX= OFFSET
   0    1*0.00E-7= 0.00           0.0000E-7= 0.00
   1    1*1.47E-2= 0.0147        -7.4970E-1=-0.7497
   2    2*2.45E-1= 0.49          -2.4990E+1=-24.99
   3    1*1.19E+1= 11.9          -5.3125E+2=-531.25
   4    1*0.00E-7= 0.00           0.0000E-7= 0.00
   5    1*1.00E+0= 1.00           0.0000E-7= 0.00
   6    1*1.00E+0= 1.00           0.0000E-7= 0.00
   7    1*1.00E+0= 1.00           0.0000E-7= 0.00
   8    1*1.00E+0= 1.00           0.0000E-7= 0.00
   9    1*2.15E+3= 2150.         -0.9970E+5=-99700.
  10    1*2.08E+3= 2080.         -1.0000E+5=-100000.
  11    1*1.30E+3= 1300.         -6.1851E+4=-61851.
  12    1*1.91E+3= 1910.         -0.9076E+5=-90760.
  13    1*1.56E+3= 1560.         -7.4262E+4=-74262.
  14    1*1.22E+3= 1220.         -5.7765E+4=-57765.
  15    1*1.94E+3= 1940.         -0.9214E+5=-92140.
  16    1*1.83E+3= 1830.         -0.8444E+5=-84440.
  17    4*1.95E+2= 780.          -0.8444E+5=-84440.
  18    2*1.38E+3= 2760.         -1.3220E+5=-132200.
  19    2*1.38E+3= 2760.         -1.3220E+5=-132200.
  20    4*2.25E+2= 900.           3.8960E+3= 3896.
  21    4*2.40E+2= 960.           4.1000E+3= 4100.
  22    1*1.04E+3= 1040.          4.5130E+3= 4513.
  23    2*2.10E+2= 420.          -2.6670E+4=-26670.
  24    4*1.80E+2= 720.           5.0650E+3= 5065.
  25    1*1.10E+3= 1100.          4.6530E+3= 4653.
  26    1*1.00E+0= 1.00           0.0000E-7= 0.00
  27    1*1.00E+0= 1.00           0.0000E-7= 0.00
  28    1*1.00E+0= 1.00           0.0000E-7= 0.00
  29    1*1.00E+0= 1.00           0.0000E-7= 0.00
  30    1*1.47E-1= 0.147         -7.5000E+0=-7.50
  31    1*1.74E-2= 0.0174         2.7253E+1= 27.253
  32    2*1.95E-1= 0.39          -3.4000E+1=-34.0
  33    1*1.00E+0= 1.00           0.0000E-7= 0.00
  34    1*1.23E-2= 0.0123        -6.2500E-1=-0.625
  35    1*2.45E-1= 0.245         -1.2495E+1=-12.495
  36    4*2.45E-1= 0.98          -4.9980E+1=-49.98
  37    1*1.47E+0= 1.47          -7.4970E+1=-74.97
  38    4*1.84E-1= 0.736         -3.7485E+1=-37.485
```

Reference No.

Correction Factor

Offset

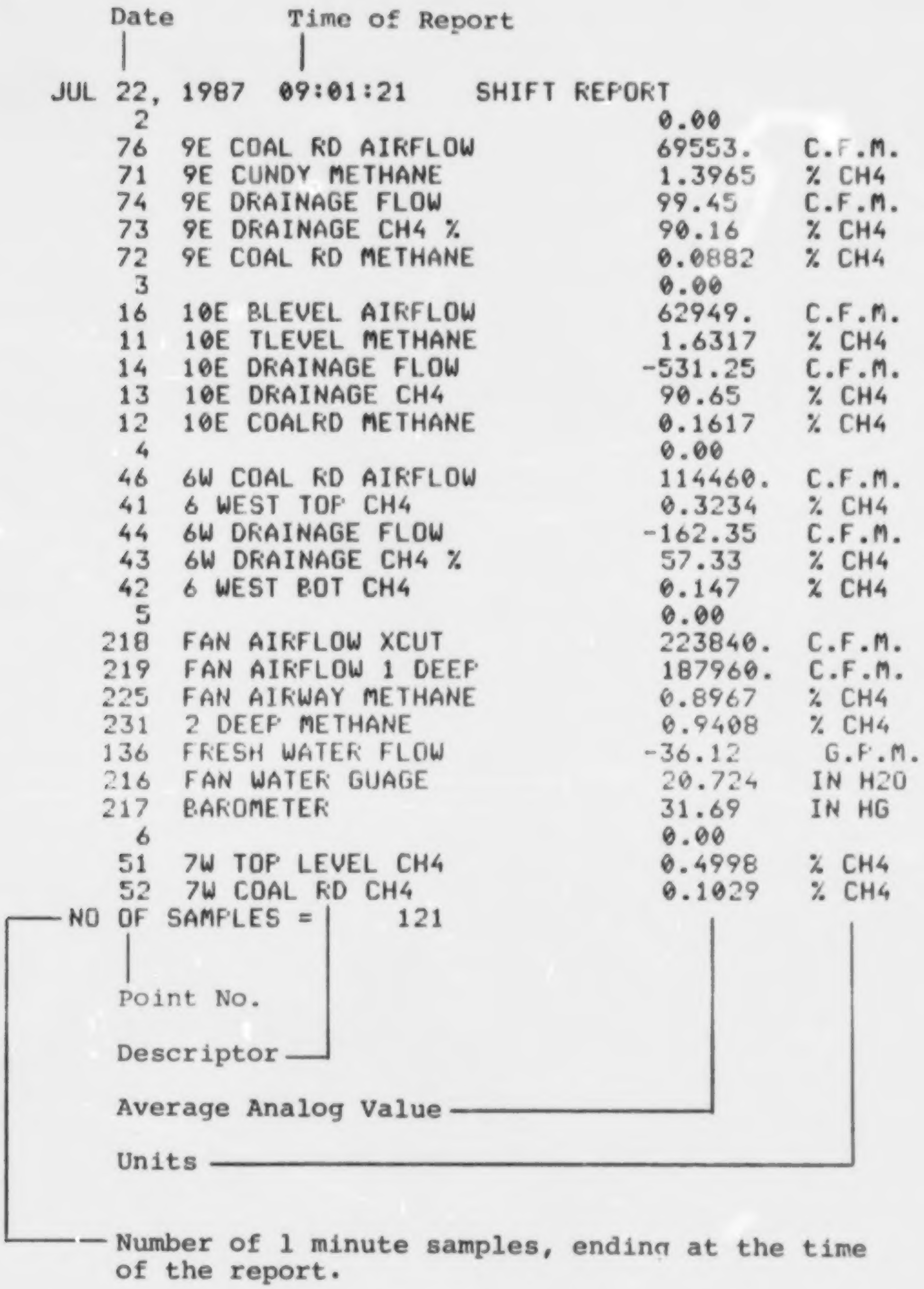
## FIG. 18: Trend Log



```
JUL 22, 1987  09:30:55     TREND  LOG
 363 9ES:METH 5:TOP FS
  75 9E T.LEVEL AIRFLOW
  77 9E OUTSIDE C. AIRF
 353 9E STUDY: METH 4
  71 9E CUNDY METHANE
  78 9E INSIDE C. AIRF
 364 9ES:METH 7:INS.TOP
 366 9ES:AIRF 4:INS.TOP
 365 9ES:METH 8:INS.BTM
 361 9ES BOTTOM AIRFL-6

            363     75     77    353     71
           % CH4         C.F.M.        % CH4
                 C.F.M.        % CH4
09:31:00   0.1323        21380.        1.1907
                  9950.        0.4557
09:32:00   0.1323        21380.        1.176
                 12100.        0.441
09:33:00   0.1176        21380.        1.176
                  9950.        0.4557
09:34:00   0.1176        20420.        1.1613
                  9950.        0.4557
09:35:00   0.1176        23300.        1.1613
                 12100.        0.441
```

Time of Report
Date
Descriptors
Point Nos.
Units
Analog Values
Time

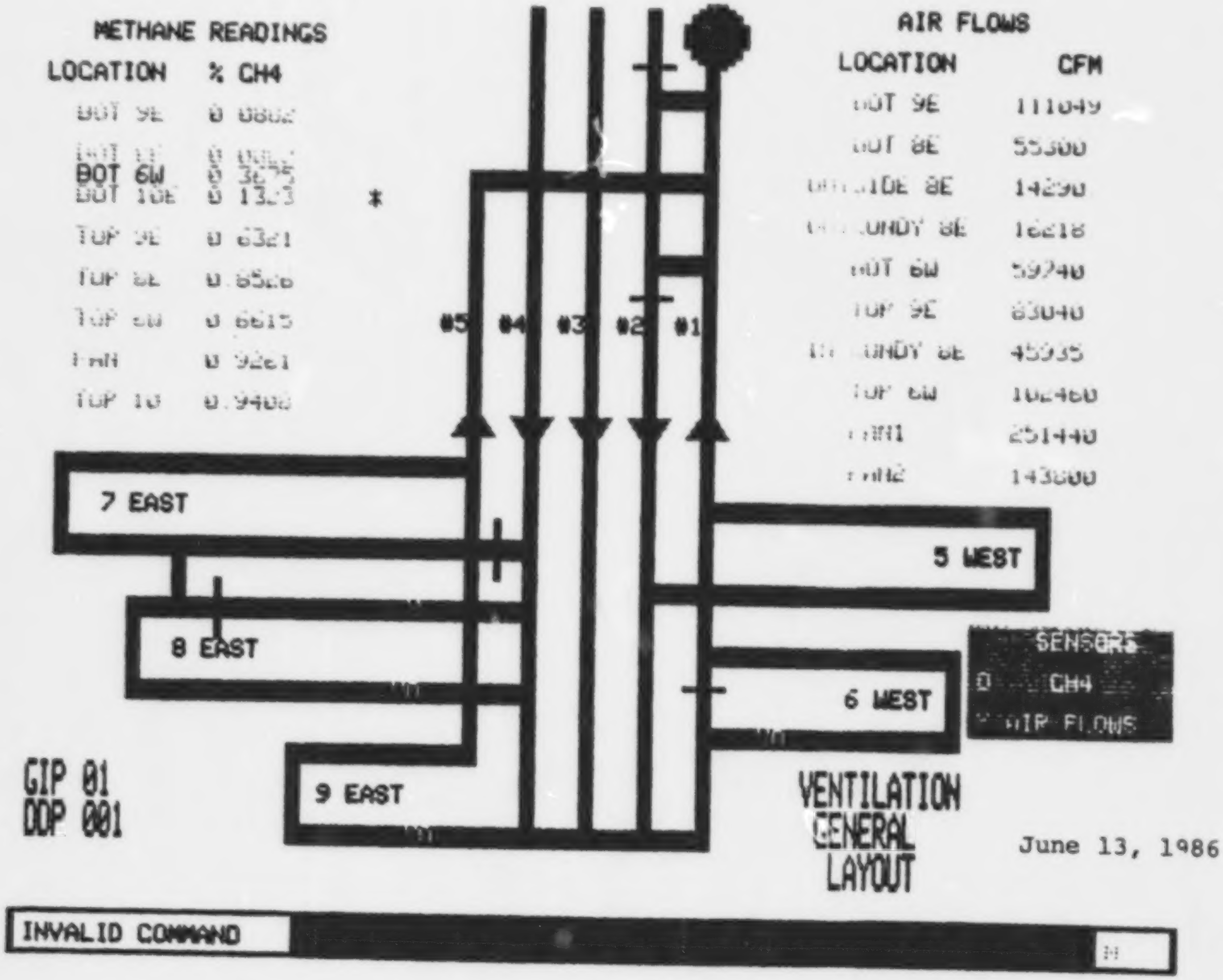
FIG.19: Shift Report



```
JUL 22, 1987  09:01:21    SHIFT REPORT
       2                                       0.00
      76  9E COAL RD AIRFLOW                   69553.     C.F.M.
      71  9E CUNDY METHANE                     1.3965     % CH4
      74  9E DRAINAGE FLOW                     99.45      C.F.M.
      73  9E DRAINAGE CH4 %                    90.16      % CH4
      72  9E COAL RD METHANE                   0.0882     % CH4
       3                                       0.00
      16  10E BLEVEL AIRFLOW                   62949.     C.F.M.
      11  10E TLEVEL METHANE                   1.6317     % CH4
      14  10E DRAINAGE FLOW                   -531.25     C.F.M.
      13  10E DRAINAGE CH4                     90.65      % CH4
      12  10E COALRD METHANE                   0.1617     % CH4
       4                                       0.00
      46  6W COAL RD AIRFLOW                   114460.    C.F.M.
      41  6 WEST TOP CH4                       0.3234     % CH4
      44  6W DRAINAGE FLOW                    -162.35     C.F.M.
      43  6W DRAINAGE CH4 %                    57.33      % CH4
      42  6 WEST BOT CH4                       0.147      % CH4
       5                                       0.00
     218  FAN AIRFLOW XCUT                     223840.    C.F.M.
     219  FAN AIRFLOW 1 DEEP                   187960.    C.F.M.
     225  FAN AIRWAY METHANE                   0.8967     % CH4
     231  2 DEEP METHANE                       0.9408     % CH4
     136  FRESH WATER FLOW                    -36.12       G.P.M.
     216  FAN WATER GUAGE                      20.724     IN H20
     217  BAROMETER                            31.69      IN HG
       6                                       0.00
      51  7W TOP LEVEL CH4                     0.4998     % CH4
      52  7W COAL RD CH4                       0.1029     % CH4
   NO OF SAMPLES =        121
```

Date
Time of Report
Point No.
Descriptor
Average Analog Value
Units
Number of 1 minute samples, ending at the time of the report.

Figure 20: Process Display Outline



METHANE READINGS

| LOCATION | % CH4 |
|---|---|
| BOT 9E | 0.0802 |
| [illegible] | 0.0062 |
| BOT 6W | 0.3675 |
| BOT 10E | 0.1323 |
| TOP 9E | 0.6321 |
| TOP 8E | 0.8526 |
| TOP 6W | 0.6615 |
| FAN | 0.9261 |
| TOP 10 | 0.9408 |

*

AIR FLOWS

| LOCATION | CFM |
|---|---|
| BOT 9E | 111049 |
| BOT 8E | 55300 |
| OUTSIDE 8E | 14290 |
| BOUNDY 8E | 16218 |
| BOT 6W | 59740 |
| TOP 9E | 83040 |
| BOUNDY 6E | 45935 |
| TOP 6W | 102460 |
| FAN1 | 251440 |
| FAN2 | 143000 |

#5
#4
#3
#2
#1
7 EAST
8 EAST
9 EAST
5 WEST
6 WEST
SENSORS
0 CH4
AIR FLOWS
GIP 01
DDP 001
VENTILATION
GENERAL
LAYOUT

INVALID COMMAND

June 13, 1986

Figure 21: Trend Plot

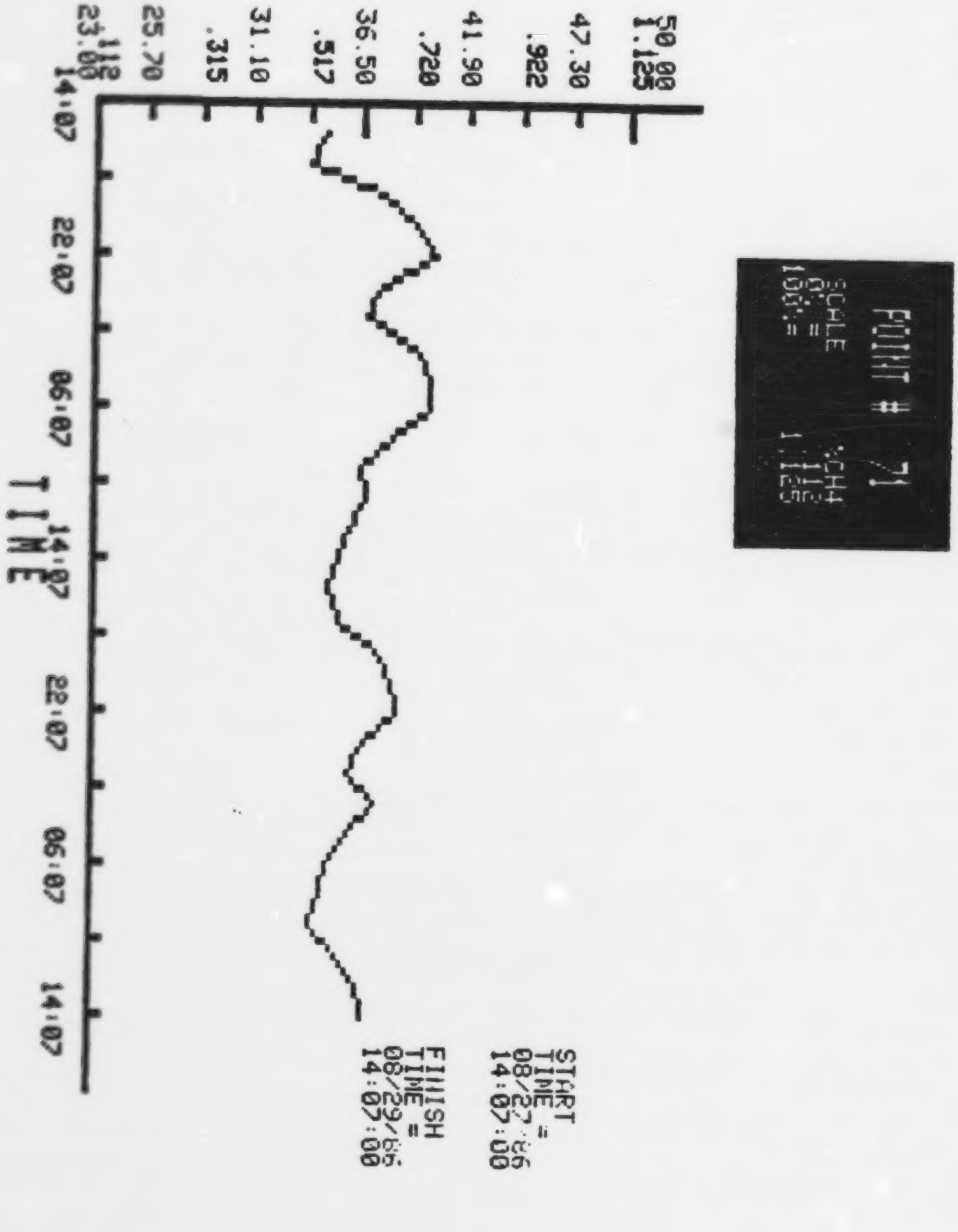
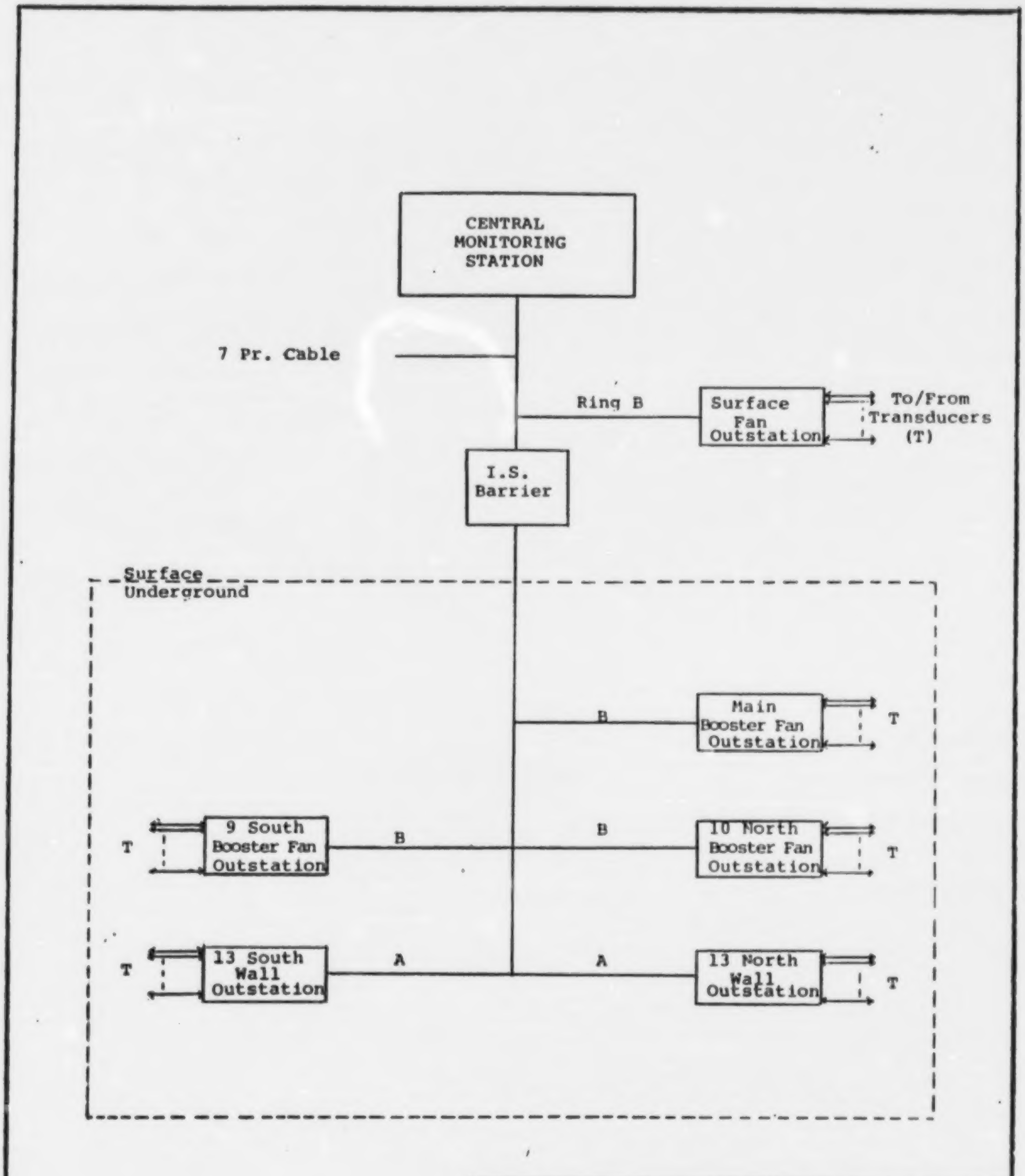


Figure 22: Schematic Layout of No. 26 Monitoring System


CENTRAL MONITORING STATION
7 Pr. Cable
Ring B
Surface Fan Outstation
To/From Transducers (T)
I.S. Barrier
Surface
Underground
Main Booster Fan Outstation
B
T
9 South Booster Fan Outstation
B
T
10 North Booster Fan Outstation
B
T
13 South Wall Outstation
A
T
13 North Wall Outstation
A
T

| CAPE BRETON DEVELOPMENT CORPORATION | SOCIÉTÉ DE DÉVELOPPEMENT DU CAP-BRETON |
|---|---|
| PROJECT OR LOCATION | CONSPEC REMOTE MONITORING STUDY |
| TITLE | Schematic Layout of 26 Colliery Monitoring System |
| Scale | N.A |

Figure 23: Schematic Layout of No. 26 Control Monitoring Station

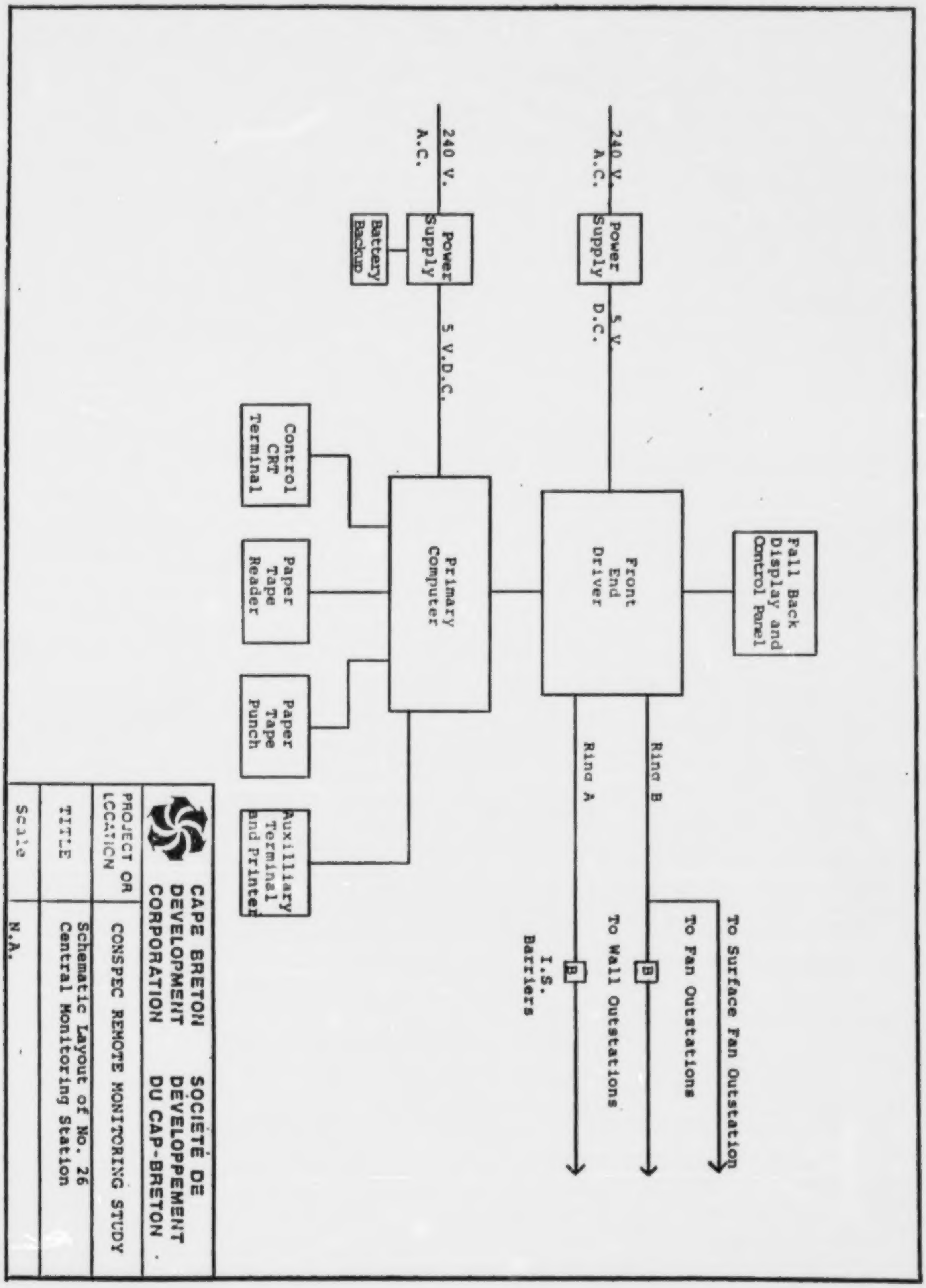

240 V. A.C.
Power Supply
5 V. D.C.
240 V. A.C.
Power Supply
Battery Backup
5 V.D.C.
Fall Back Display and Control Panel
Front End Driver
Primary Computer
Control CRT Terminal
Paper Tape Reader
Paper Tape Punch
Auxilliary Terminal and Printer
Ring B
Ring A
To Surface Fan Outstation
To Fan Outstations
To Wall Outstations
B
B
I.S. Barriers
CAPE BRETON DEVELOPMENT CORPORATION
SOCIÉTÉ DE DÉVELOPPEMENT DU CAP-BRETON
PROJECT OR LOCATION
CONSPEC REMOTE MONITORING STUDY
TITLE
Schematic Layout of No. 26 Central Monitoring Station
Scale
N.A.

**Figure 24:** MONITOR SCREEN LAYOUT

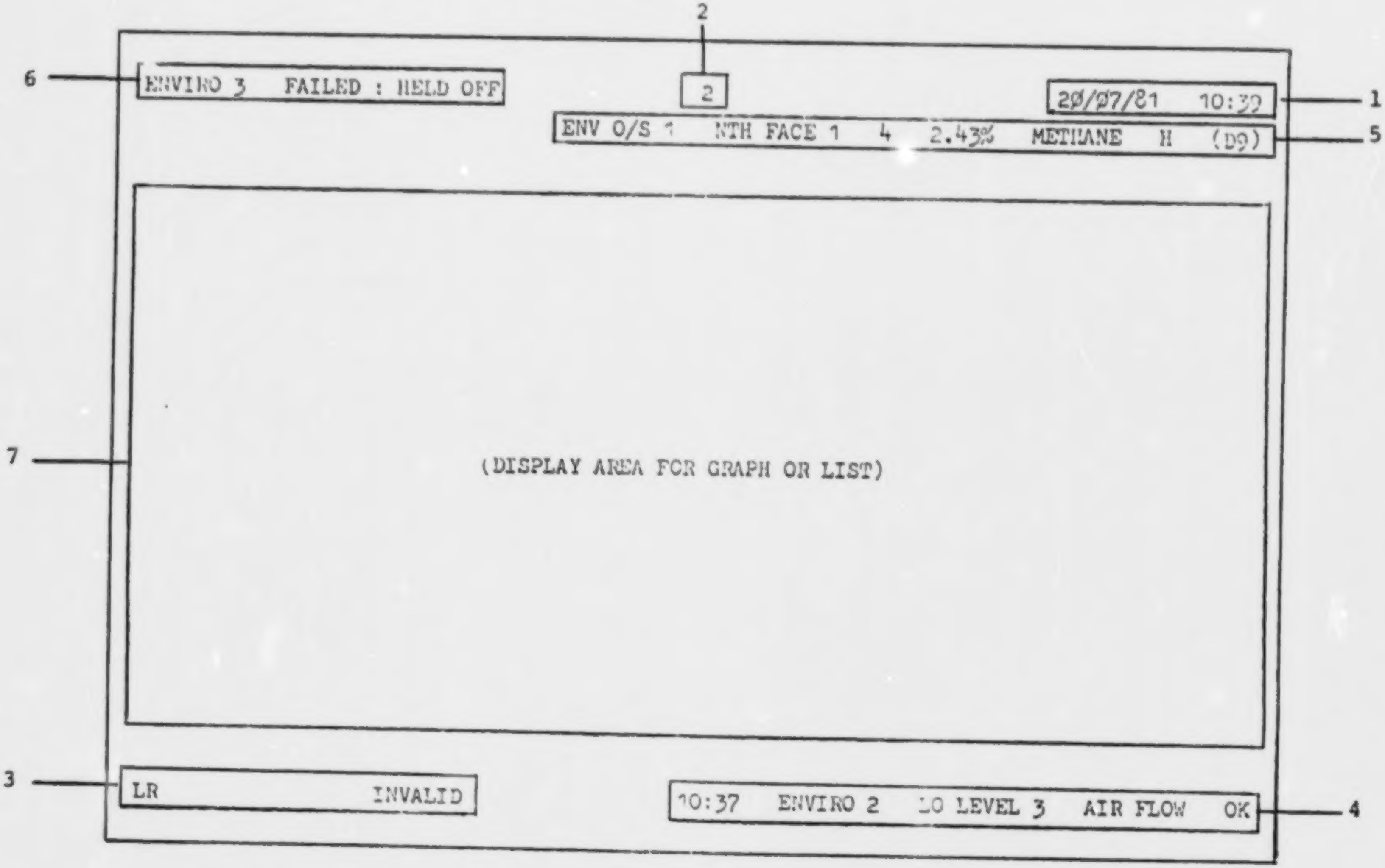

2
6
ENVIRO 3 FAILED : HELD OFF
2
20/07/81 10:39
1
ENV O/S 1 NTH FACE 1 4 2.43% METHANE H (D9)
5
7
(DISPLAY AREA FOR GRAPH OR LIST)
3
LR INVALID
10:37 ENVIRO 2 LO LEVEL 3 AIR FLOW OK
4

Figure 25: List of Report Options

| INFORMATION OPTIONS | TYPE O FOR CONTROL COMMANDS |
|---|---|
| LO | LIST OUTSTATIONS |
| LAX | LIST ALARMS FOR ALL OUTSTATION KINDS |
| LAE | LIST ALARMS FOR OUTSTATION KIND 'E' |
| LL | LIST LOG OF ALARMS |
| LKE01 | LIST OUTSTATION KIND 'E' TYPE 01 |
| LSB01 | LIST OUTSTATION STAUTS B01 |
| LGB031 | LIST GRAPH OUTSTATION B03, ANALOGUE 1 |
| LX | LIST ANALOGUES SELECTED FOR GRAPHS |
| LY | LIST TRANSDUCER TYPES |
| LN | LIST ANALOGUES |
| LSBM1A | LIST STATUS OF ALL TRANSDUCERS TYPE BM1A |
| LU01 | LIST STATUS OF TRANSDUCERS FOR ANALOGUE GROUP 01 |
| LD | LIST DEFINED ANALOGUE GROUPS |
| T* | TYPE * AS FOR LIST COMMANDS |
| ↑W | CLEAR ALARM LOG |

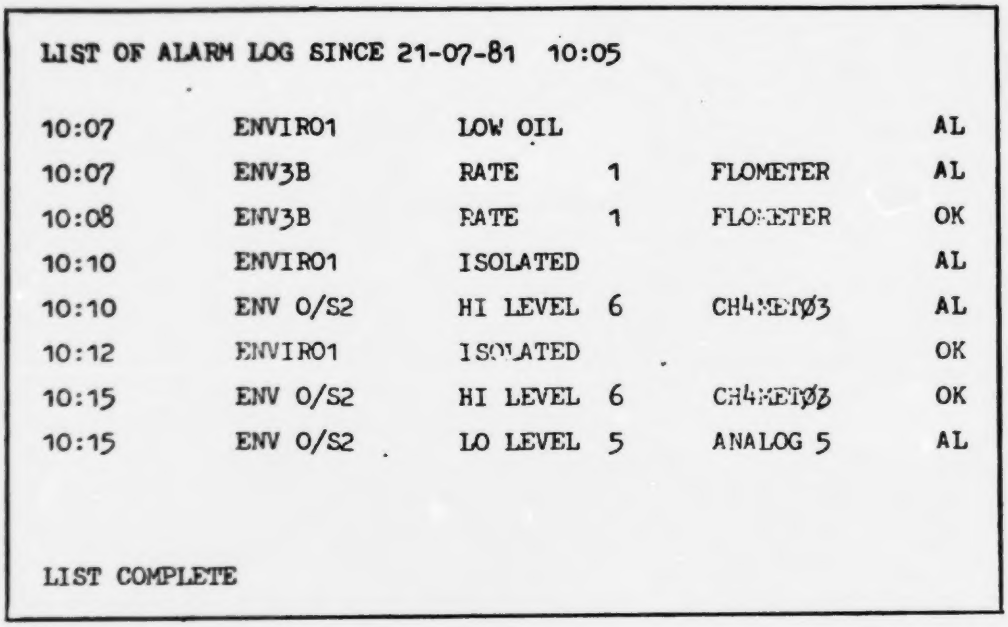
Figure 26: List of All Outstations

```
LIST OF OUTSTATIONS

O/S        NAME          KIND          TYPE

A01        ENVIRA1       ENVRMNTL      01

A02        ENVIRA2       ENVRMNTL      02

A03        CONTROL1      PUMP          01

B01        ENV EAST      ENVRMNTL      01

B02        ENV WEST      ENVRMNTL      03

B03        ENV STH1      ENVRMNTL      02


LIST COMPLETE
```

Figure 27: List of Alarms of An Outstation Type

```
LIST OF ENVIRNTL ALARMS

ENV O/S1      HI LEVEL    7        ANALOG7       AL
ENVIRO2       ISOLATED                           AL
ENV3B         NO FLOW                            AL
ENV O/S1      RATE        1        FLOMETER      AL
ENV3B         HI LEVEL    2        MH4METER      AL
ENV3B         LO LEVEL    5        AIRPRESS      AL
ENVIRO2       DIG1 FAULT                         AL






LIST COMPLETE
```

Figure 28: List of Recent Alarms

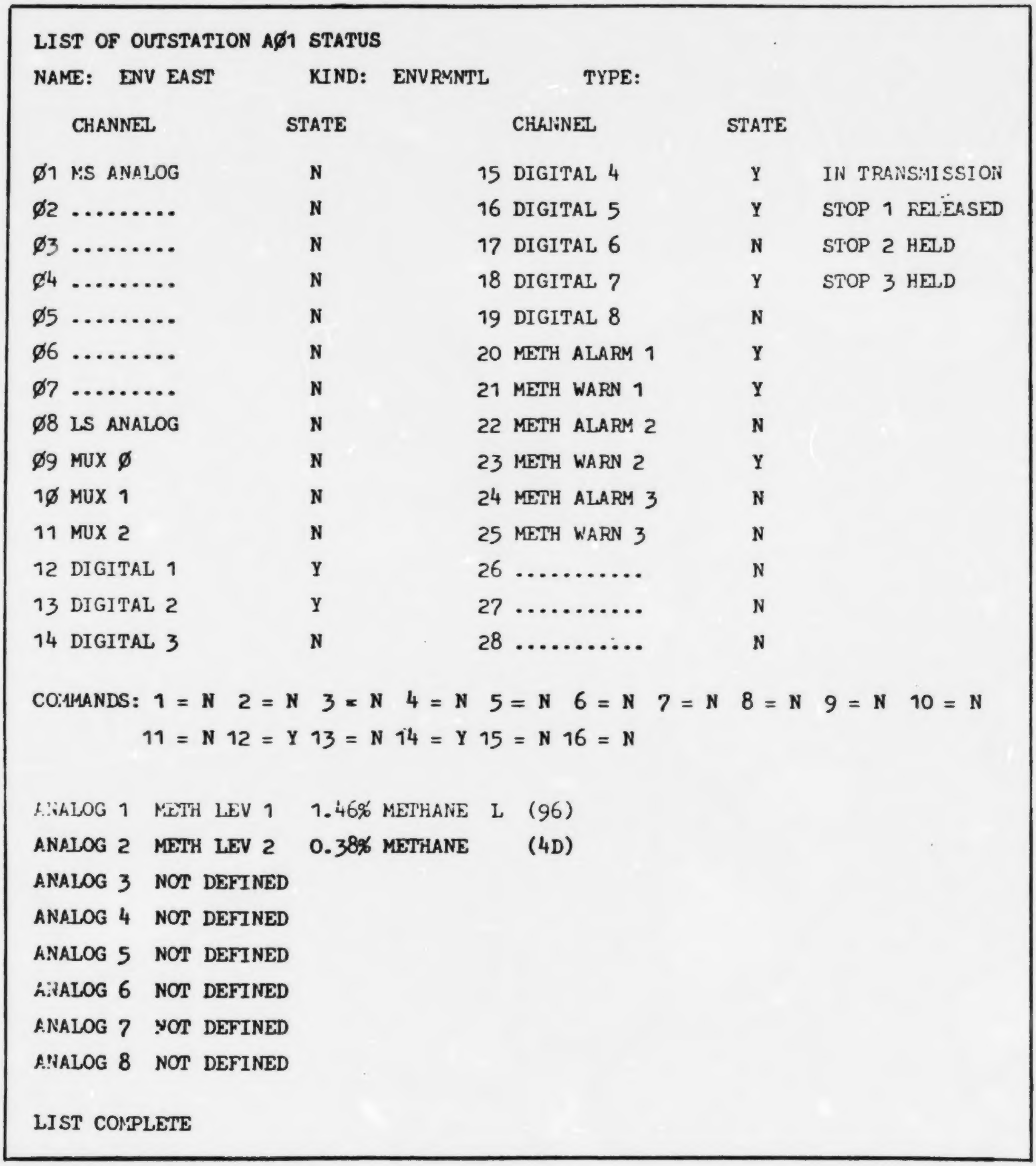


```
LIST OF ALARM LOG SINCE 21-07-81  10:05

10:07        ENVIRO1      LOW OIL                          AL
10:07        ENV3B        RATE       1     FLOMETER        AL
10:08        ENV3B        RATE       1     FLOMETER        OK
10:10        ENVIRO1      ISOLATED                         AL
10:10        ENV O/S2     HI LEVEL   6     CH4MET03        AL
10:12        ENVIRO1      ISOLATED                         OK
10:15        ENV O/S2     HI LEVEL   6     CH4MET03        OK
10:15        ENV O/S2     LO LEVEL   5     ANALOG 5        AL


LIST COMPLETE
```

Figure 29: List of Outstations of A Type

```
LIST OF OUTSTATION KIND ENVIRONMENTAL TYPE 01

CHANNEL              AL

01 MS ANALOG          N
02 .........          N
03 .........          N
04 .........          N
05 .........          N
06 .........          N
07 .........          N
08 LS ANALOG          N
09 MUX 0              N
10 MUX 1              N
11 MUX 2              N
12 U/G MAINS          Y
13 COM FAULT          Y
14 AN1 ALARM          Y
15 AN2 ALARM          Y
16 AN3 ALARM          Y
17 AN4 ALARM          Y
18 CONT IN 1          N
19 CONT IN 2          N
20 LOCAL              Y
21 .........          N
22 CONT IN 3          N
23 SIG COUNT 1        N
24 SIG COUNT 2        N


LIST COMPLETE
```

Figure 30: List Outstation Status



```
LIST OF OUTSTATION A01 STATUS
NAME:  ENV EAST         KIND:  ENVRMNTL        TYPE:

   CHANNEL              STATE          CHANNEL            STATE

01 MS ANALOG              N          15 DIGITAL 4           Y    IN TRANSMISSION
02 .........              N          16 DIGITAL 5           Y    STOP 1 RELEASED
03 .........              N          17 DIGITAL 6           N    STOP 2 HELD
04 .........              N          18 DIGITAL 7           Y    STOP 3 HELD
05 .........              N          19 DIGITAL 8           N
06 .........              N          20 METH ALARM 1        Y
07 .........              N          21 METH WARN 1         Y
08 LS ANALOG              N          22 METH ALARM 2        N
09 MUX 0                  N          23 METH WARN 2         Y
10 MUX 1                  N          24 METH ALARM 3        N
11 MUX 2                  N          25 METH WARN 3         N
12 DIGITAL 1              Y          26 ...........         N
13 DIGITAL 2              Y          27 ...........         N
14 DIGITAL 3              N          28 ...........         N

COMMANDS: 1 = N  2 = N  3 = N  4 = N  5 = N  6 = N  7 = N  8 = N  9 = N  10 = N
          11 = N 12 = Y 13 = N 14 = Y 15 = N 16 = N


ANALOG 1  METH LEV 1  1.46% METHANE  L  (96)
ANALOG 2  METH LEV 2  0.38% METHANE     (4D)
ANALOG 3  NOT DEFINED
ANALOG 4  NOT DEFINED
ANALOG 5  NOT DEFINED
ANALOG 6  NOT DEFINED
ANALOG 7  NOT DEFINED
ANALOG 8  NOT DEFINED

LIST COMPLETE
```

Figure 31:  Graph of Analog Output

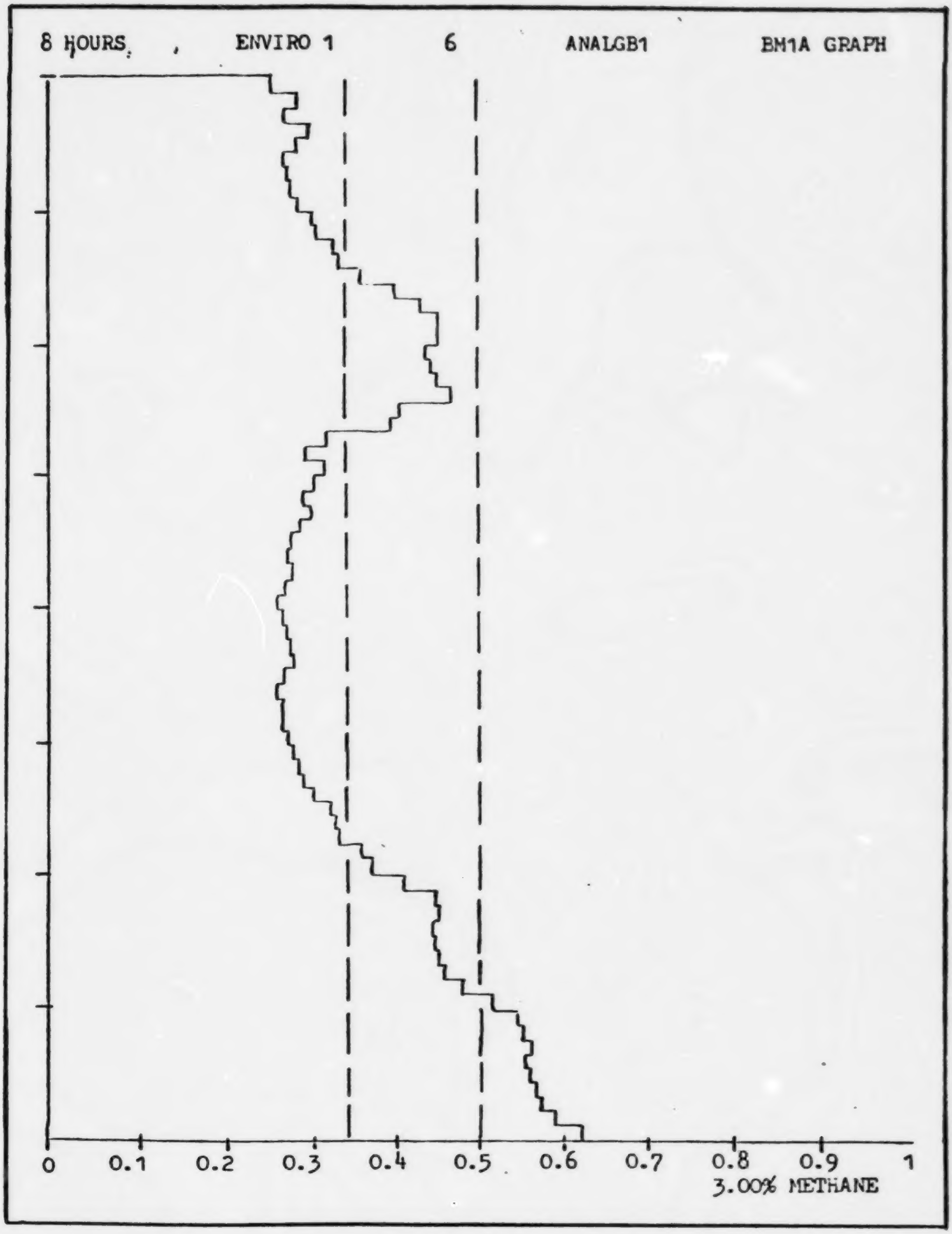
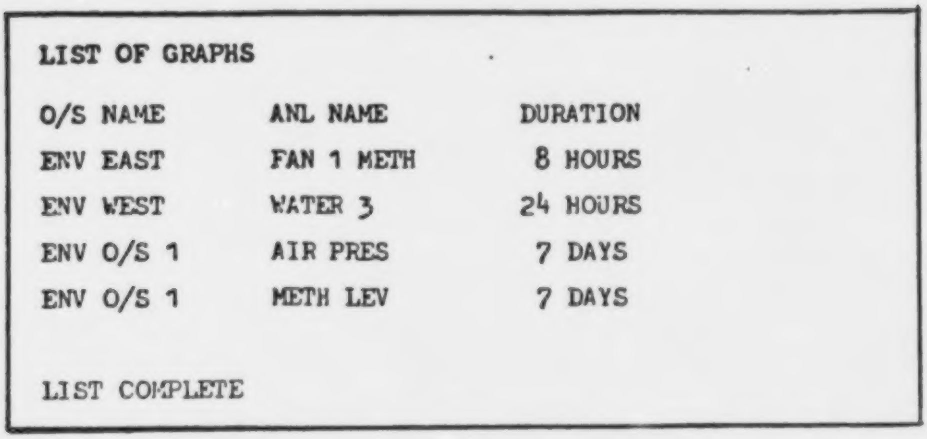
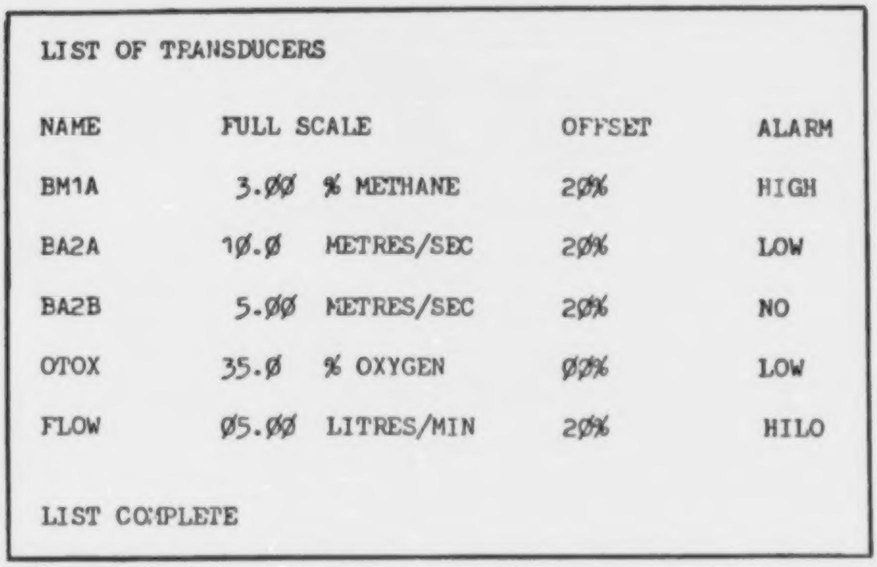


Figure 32: List of Analogs Selected for Graphs



```
LIST OF GRAPHS

O/S NAME        ANL NAME         DURATION
ENV EAST        FAN 1 METH        8 HOURS
ENV WEST        WATER 3          24 HOURS
ENV O/S 1       AIR PRES          7 DAYS
ENV O/S 1       METH LEV          7 DAYS


LIST COMPLETE
```

Figure 33: List of Analog Transcuers

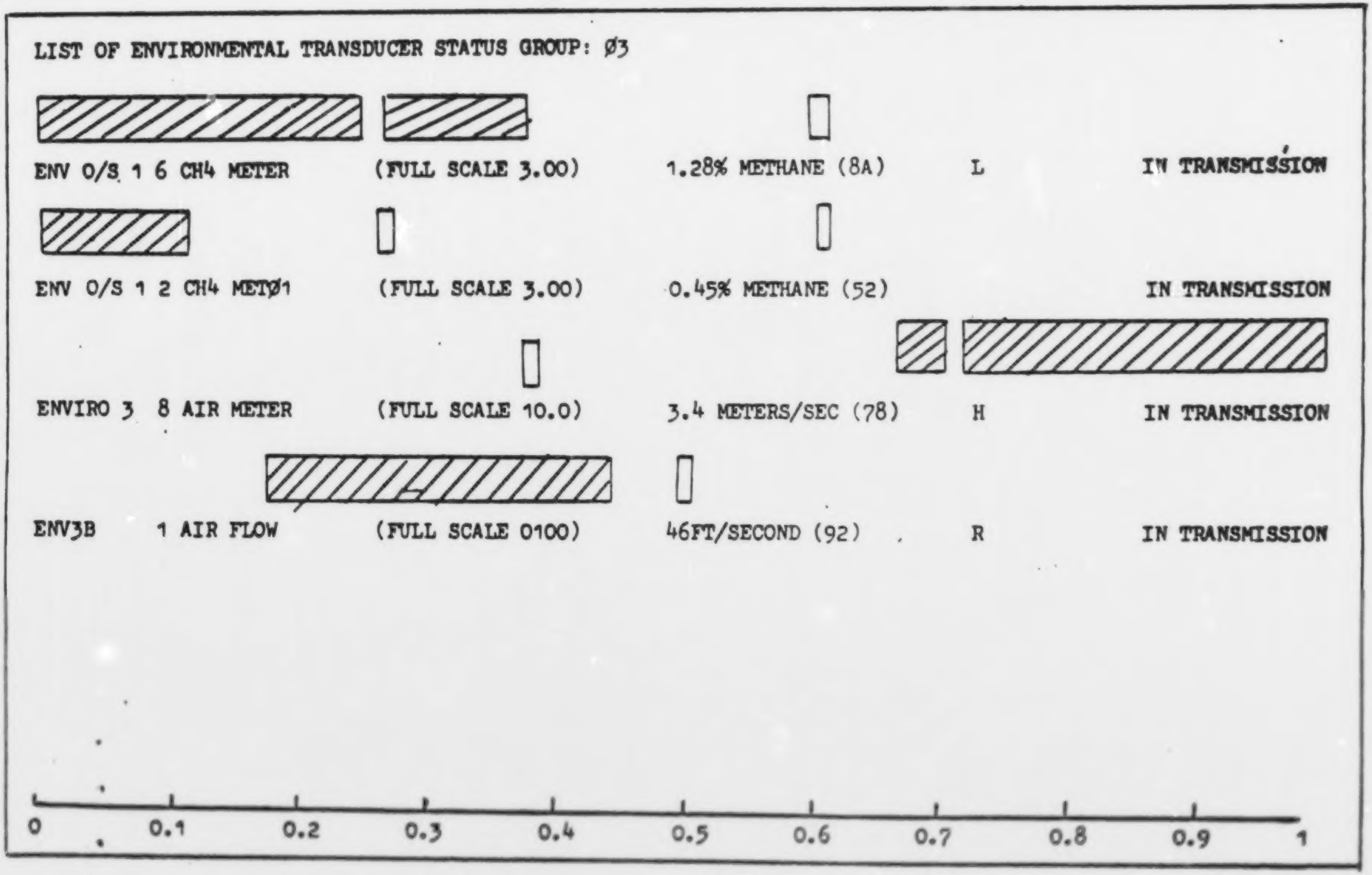


```
LIST OF TRANSDUCERS

NAME         FULL SCALE                OFFSET     ALARM

BM1A          3.00  % METHANE          200%       HIGH

BA2A         10.0   METRES/SEC         200%       LOW

BA2B          5.00  METRES/SEC         200%       NO

OTOX         35.0   % OXYGEN           000%       LOW

FLOW         05.00  LITRES/MIN         200%       HILO


LIST COMPLETE
```

Figure 34: List of Parameters of Analog Transducers by Outstation

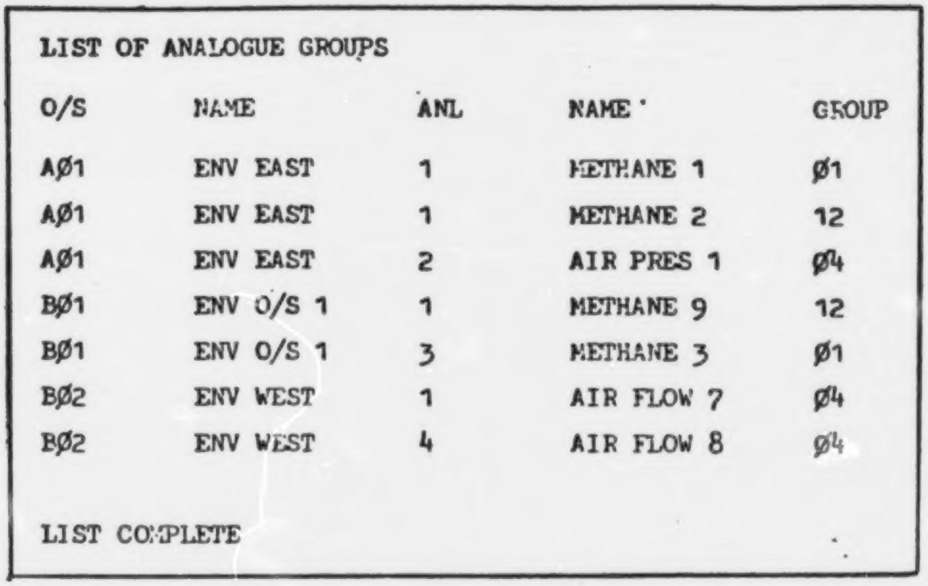
```
LIST OF ANALOGUES

O/S   ANL   NAME          TYPE   FULL SCALE        AL LOW   AL HIGH   RATE   INS FAIL

A01   1     FAN I/B       BM1A   3.00% METHANE     Y50%     Y66%      N00%   Y

A01   2     NOT DEFINED

A01   3     NOT DEFINED

A01   4     FAN 1 AIR     BA2    10.0 METRES/      Y10%     N80%      N00%   Y
                                      SEC

B03   1     METH FAN 6    BM1A   3.00% METHANE     Y50%     Y66%      N00%   Y

B03   2     H20 PIPE 3    FLOW   0500 LITRES/      N10%     Y95%      N05%   N
                                      SEC

B03   3     NOT DEFINED

B03   4     NOT DEFINED


LIST COMPLETE
```

Figure 35: List status of a Group of Analog Transducers



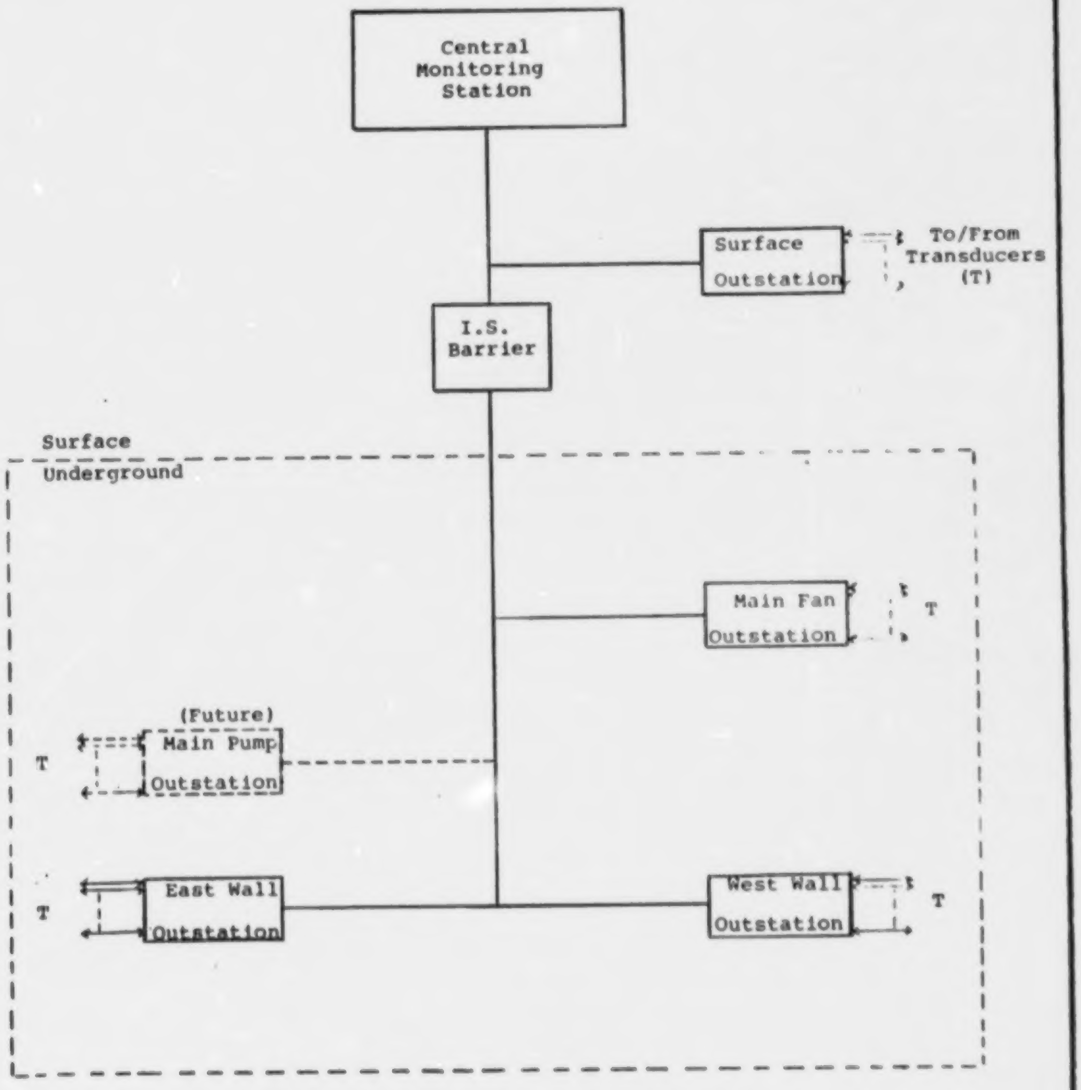
```
LIST OF ENVIRONMENTAL TRANSDUCER STATUS GROUP: Ø3

ENV O/S 1 6 CH4 METER    (FULL SCALE 3.00)   1.28% METHANE (8A)     L     IN TRANSMISSION

ENV O/S 1 2 CH4 METØ1    (FULL SCALE 3.00)   0.45% METHANE (52)           IN TRANSMISSION

ENVIRO 3  8 AIR METER    (FULL SCALE 10.0)   3.4 METERS/SEC (78)    H     IN TRANSMISSION

ENV3B     1 AIR FLOW     (FULL SCALE 0100)   46FT/SECOND (92)       R     IN TRANSMISSION
```

Figure 36: List of Analogue Groups



```
LIST OF ANALOGUE GROUPS

O/S        NAME           ANL       NAME            GROUP

A01        ENV EAST       1         METHANE 1       01
A01        ENV EAST       1         METHANE 2       12
A01        ENV EAST       2         AIR PRES 1      04
B01        ENV O/S 1      1         METHANE 9       12
B01        ENV O/S 1      3         METHANE 3       01
B02        ENV WEST       1         AIR FLOW 7      04
B02        ENV WEST       4         AIR FLOW 8      04


LIST COMPLETE
```

Figure 37: Schematic Layout of Prince Mine Monitoring System


Central Monitoring Station
Surface Outstation
To/From Transducers (T)
I.S. Barrier
Surface
Underground
Main Fan Outstation
T
(Future)
Main Pump Outstation
T
East Wall Outstation
T
West Wall Outstation
T

| | |
|---|---|
| CAPE BRETON DEVELOPMENT CORPORATION | SOCIÉTÉ DE DÉVELOPPEMENT DU CAP-BRETON |
| PROJECT OR LOCATION | CONSPEC REMOTE MONITORING STUDY |
| TITLE | Schematic Layout of Prince Mine Monitoring System |
| Scale | N.A. |

Figure 38: Schematic Layout of Prince Mine Central Monitoring Station

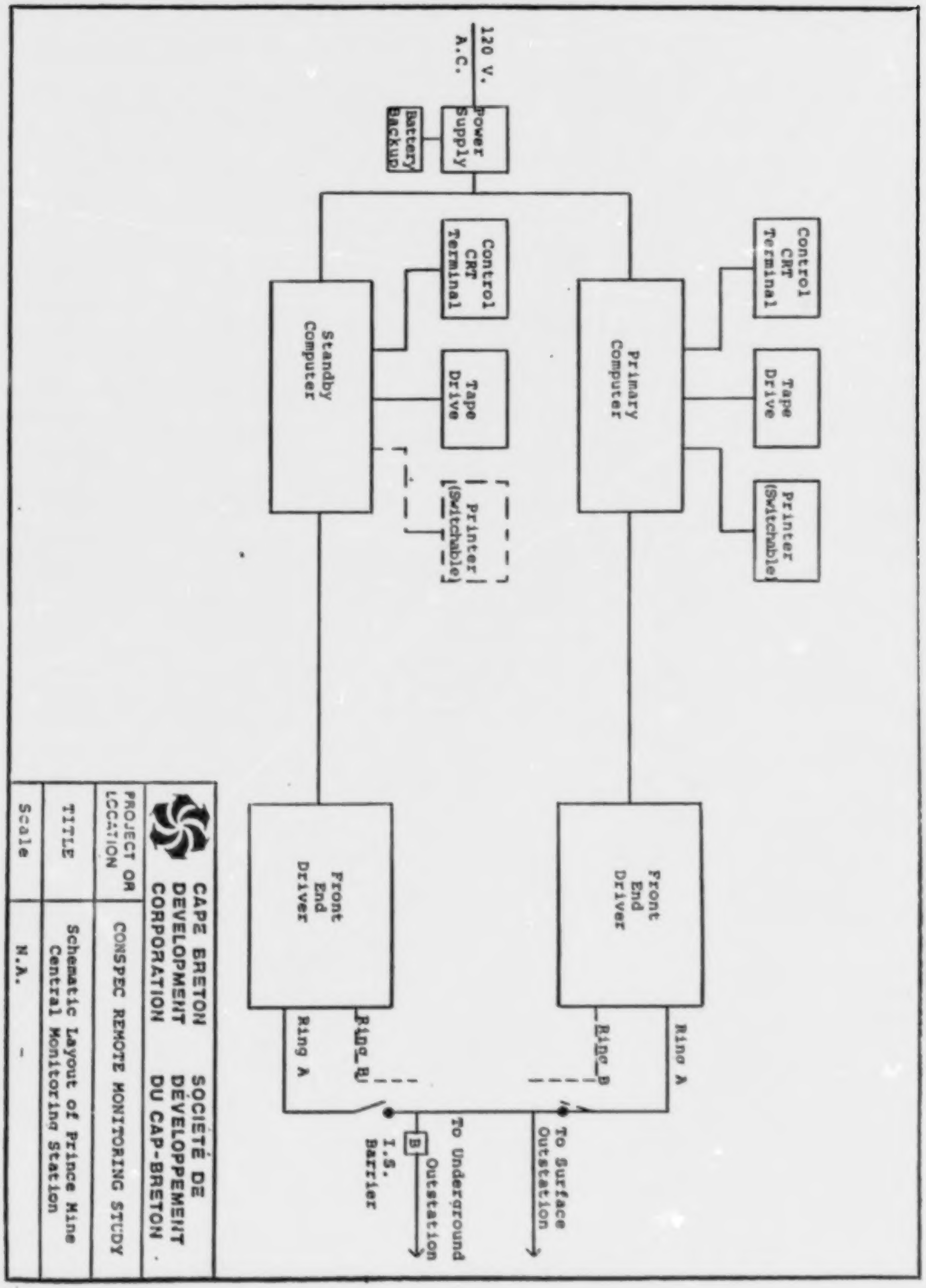

120 V.
A.C.
Power Supply
Battery Backup
Control CRT Terminal
Tape Drive
Printer (Switchable)
Primary Computer
Control CRT Terminal
Tape Drive
Printer (Switchable)
Standby Computer
Front End Driver
Front End Driver
Ring A
Ring B
Ring B
Ring A
To Surface Outstation
To Underground Outstation
B
I.S. Barrier
CAPE BRETON DEVELOPMENT CORPORATION
SOCIÉTÉ DE DÉVELOPPEMENT DU CAP-BRETON
PROJECT OR LOCATION
CONSPEC REMOTE MONITORING STUDY
TITLE
Schematic Layout of Prince Mine Central Monitoring Station
Scale
N.A.

Figure 39: J-Tec Calibration

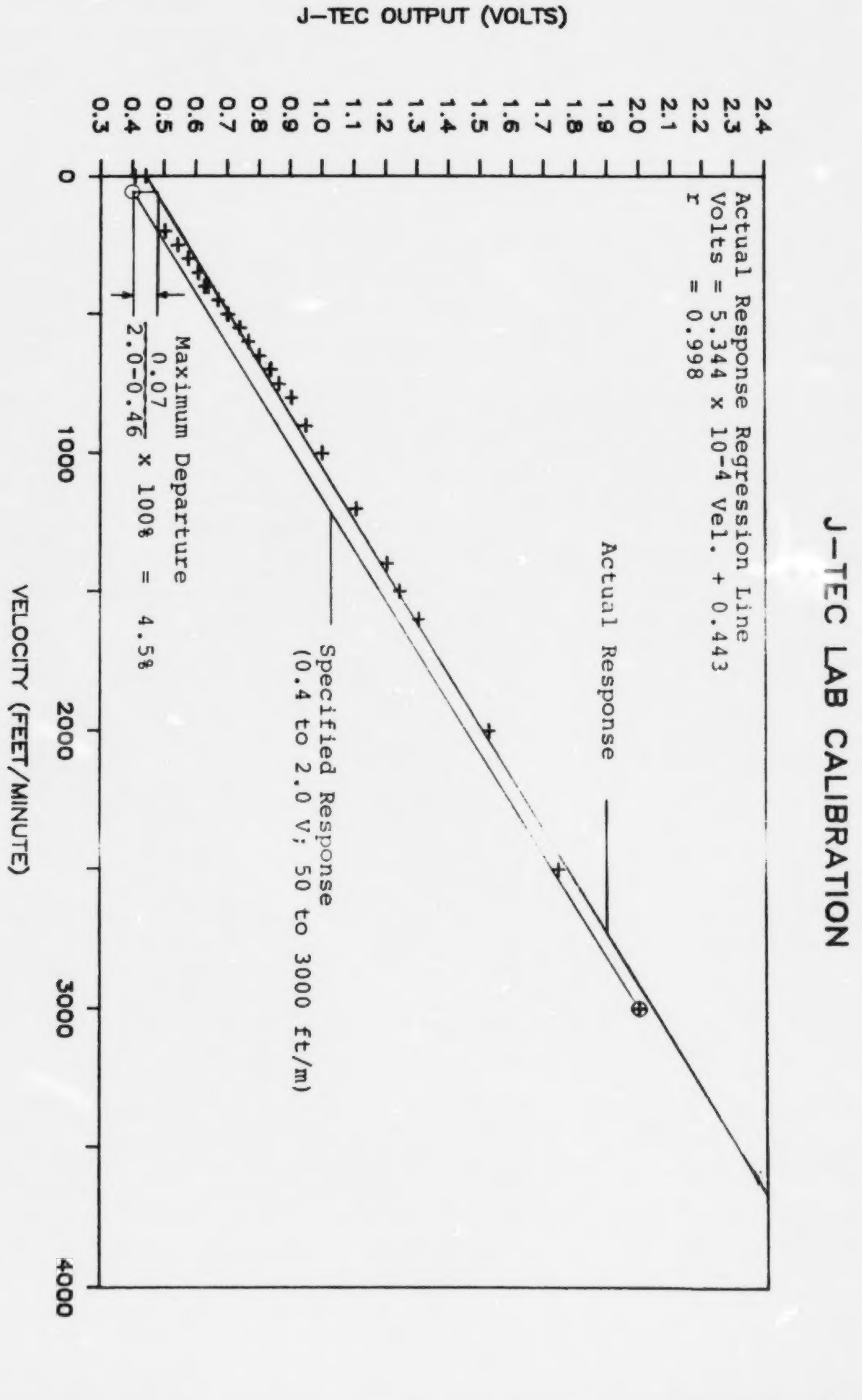


Figure 40: J-Tec Calibration - Maximum Error

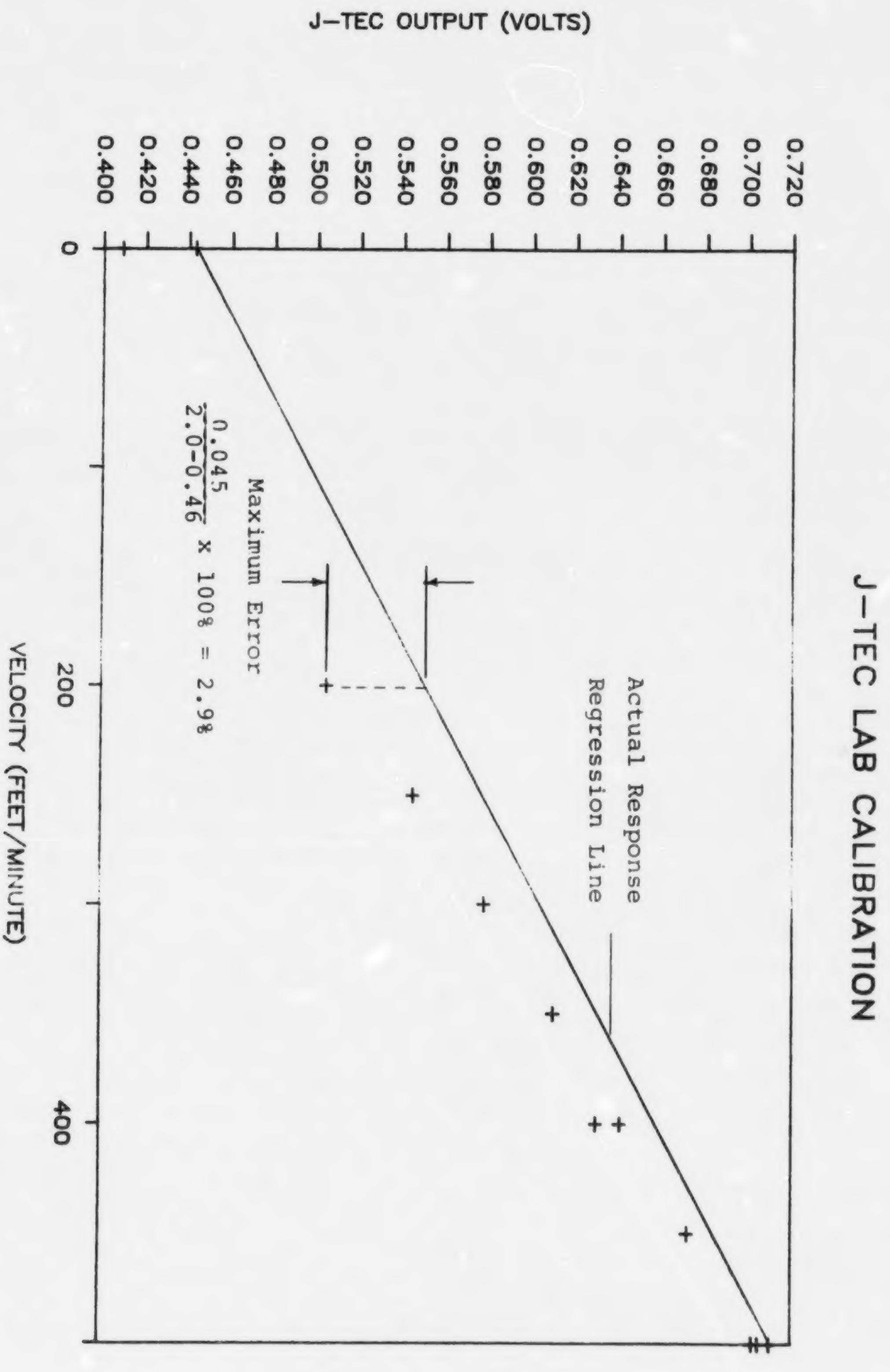


Figure 41: J-Tec Span Adjustment

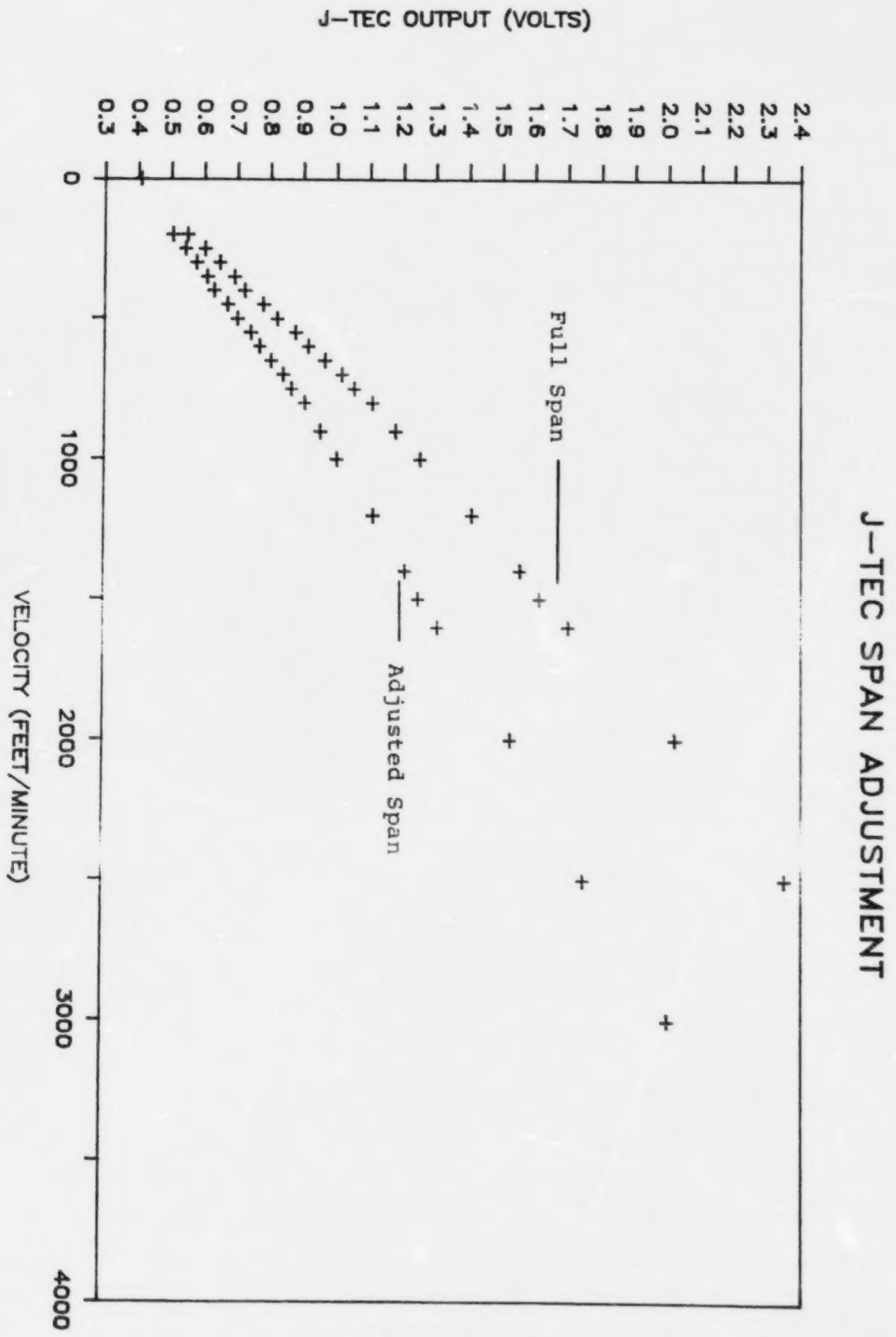


Figure 42: J-Tec Calibration Method

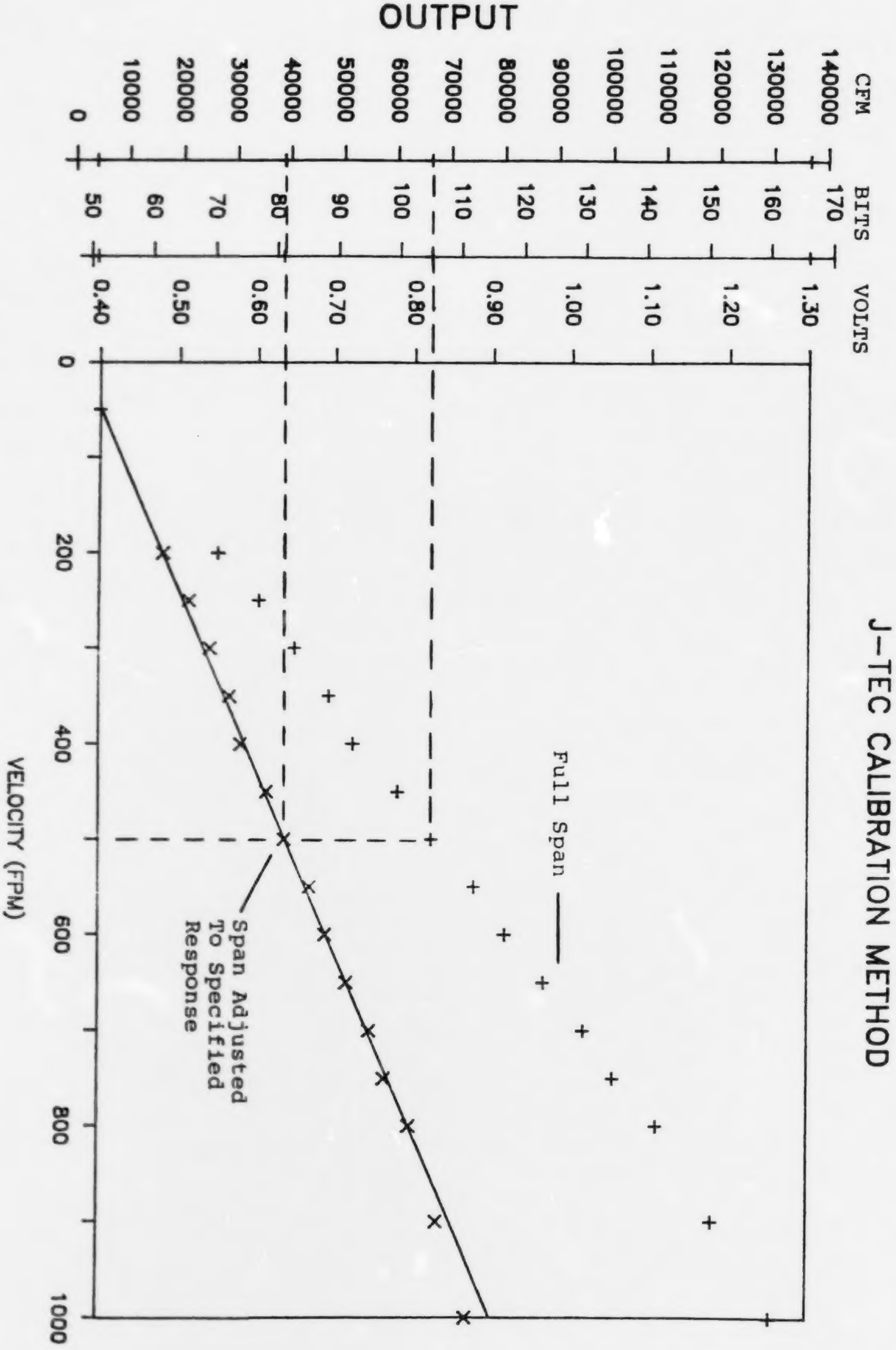


Figure 43: J-Tec Alternative Calibration Method

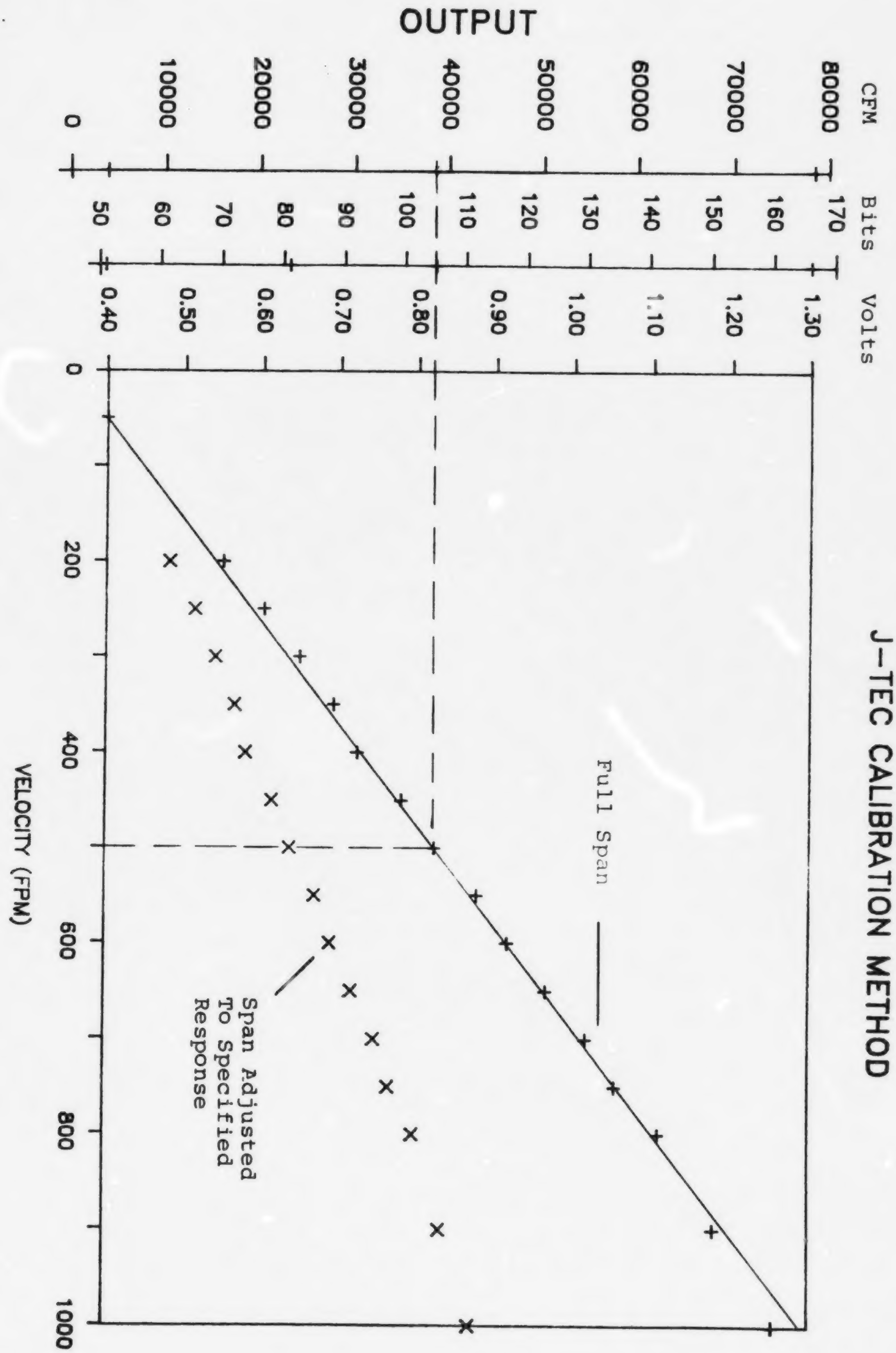


Figure 44: Trolex Lab Calibration

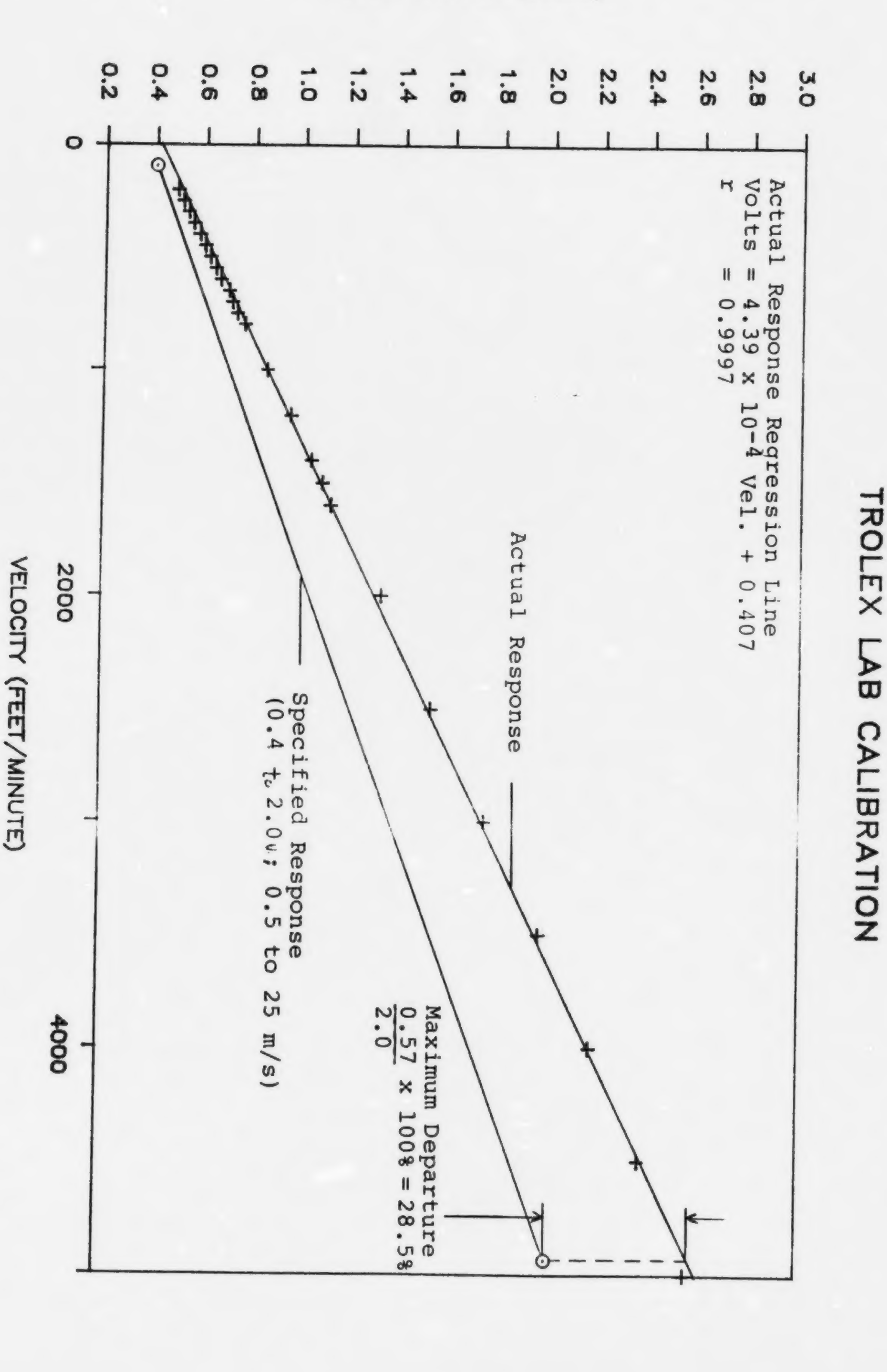


Figure 45: Trolex Lab Calibration - Maximum Error

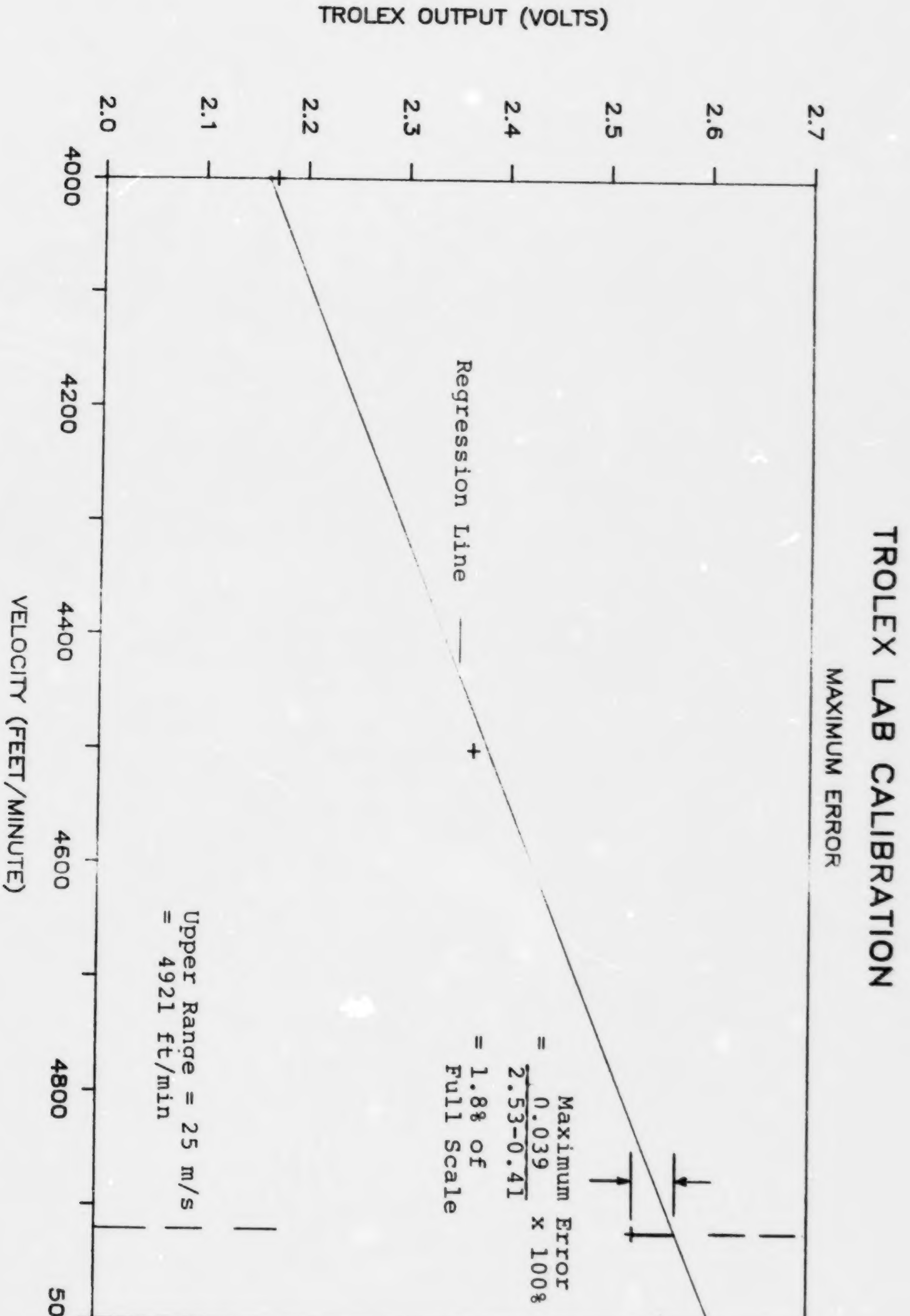


Figure 46: Trolex Monitor Calibration

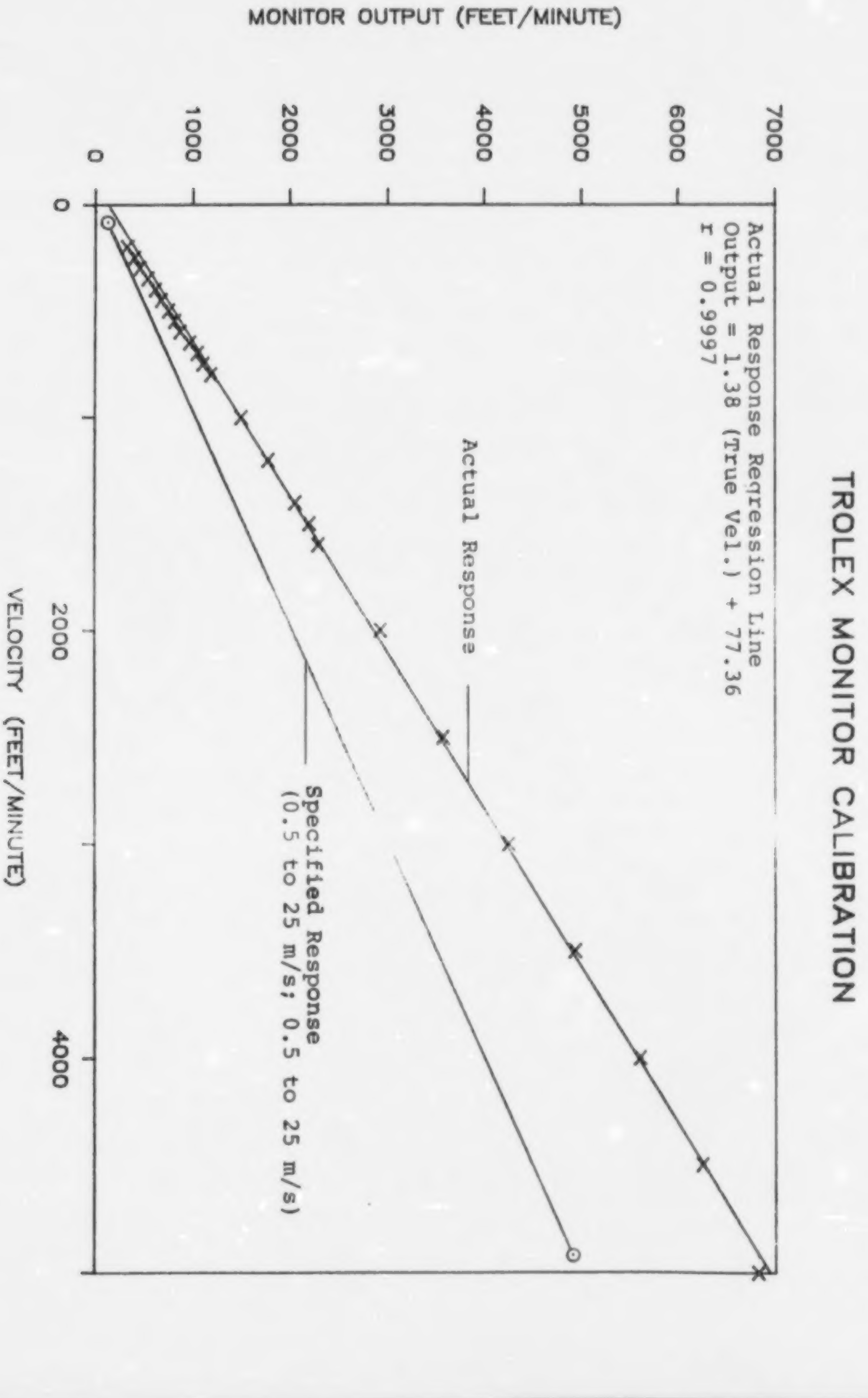


Figure 47: Sieger BA5 Lab Calibration - Velocity Ranges

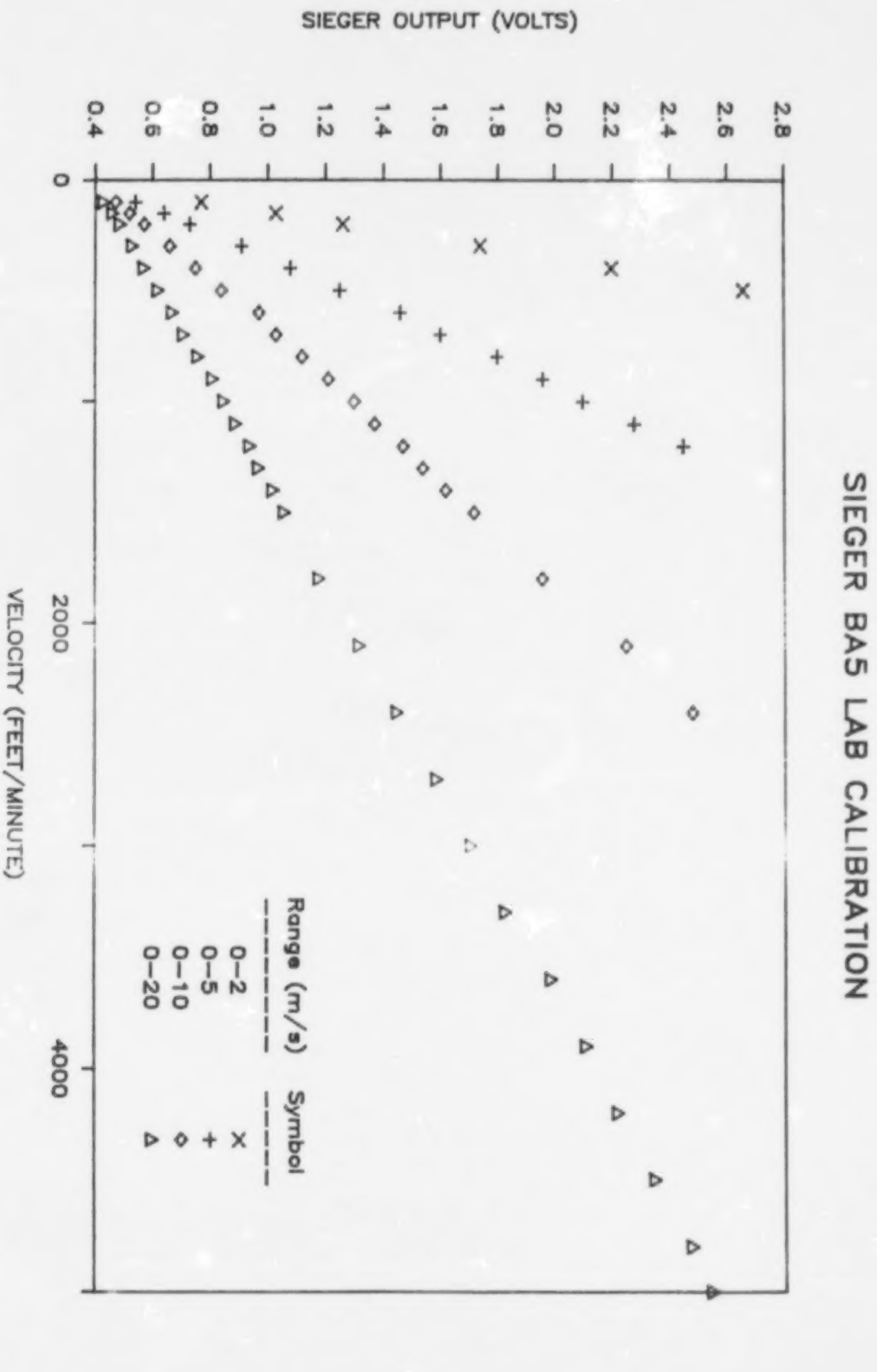


Figure 48: Sieger BA5 Calibration - 0 to 2 m/s Range

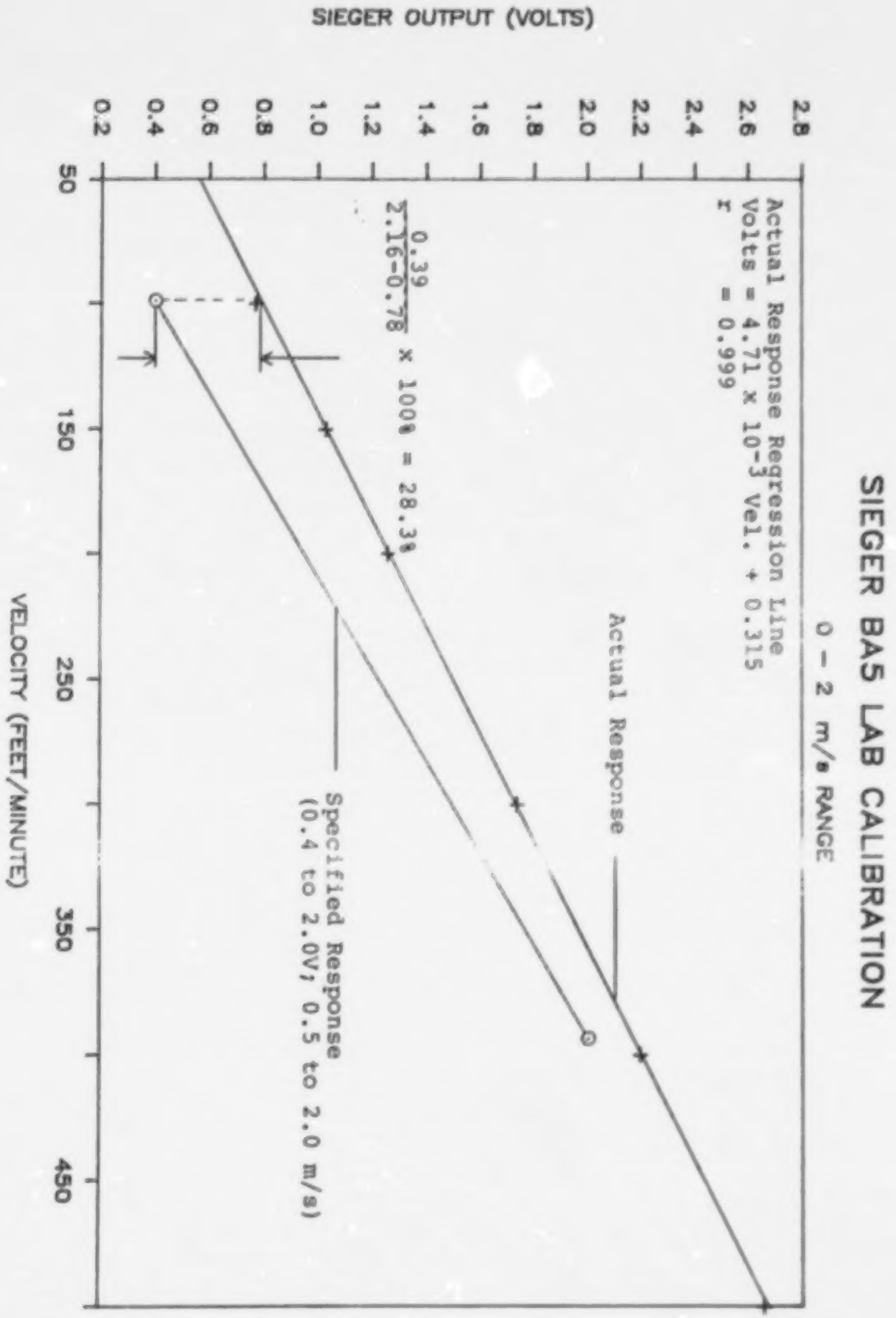


Figure 49: Sieger BA5 Lab Calibration - 0 to 5 m/s Range

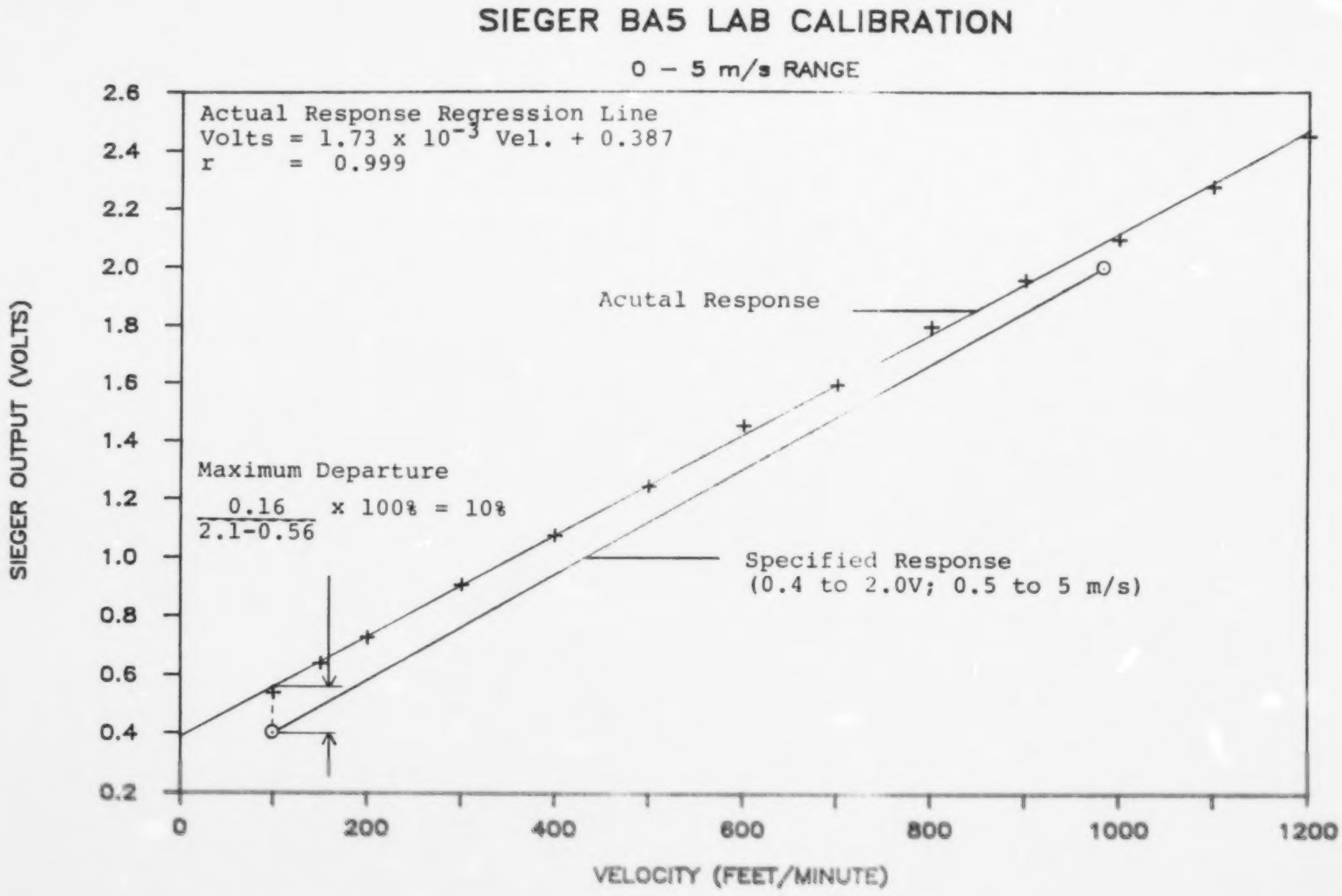


Figure 50: Sieger BA5 Lab Calibration - 0 to 10 m/s Range

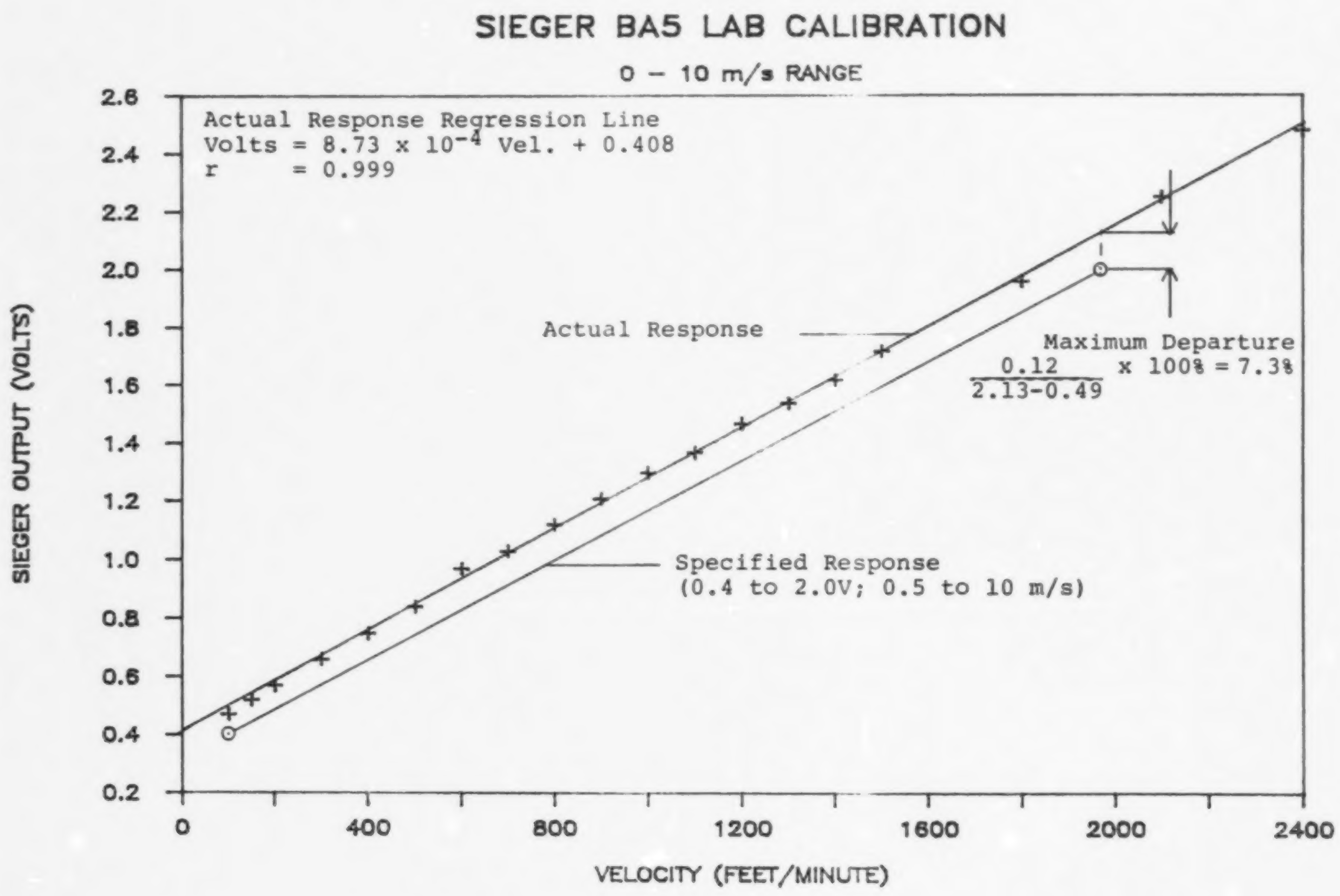


Figure 51: Sieger BA5 Lab Calibration - 0 to 20 m/s Range

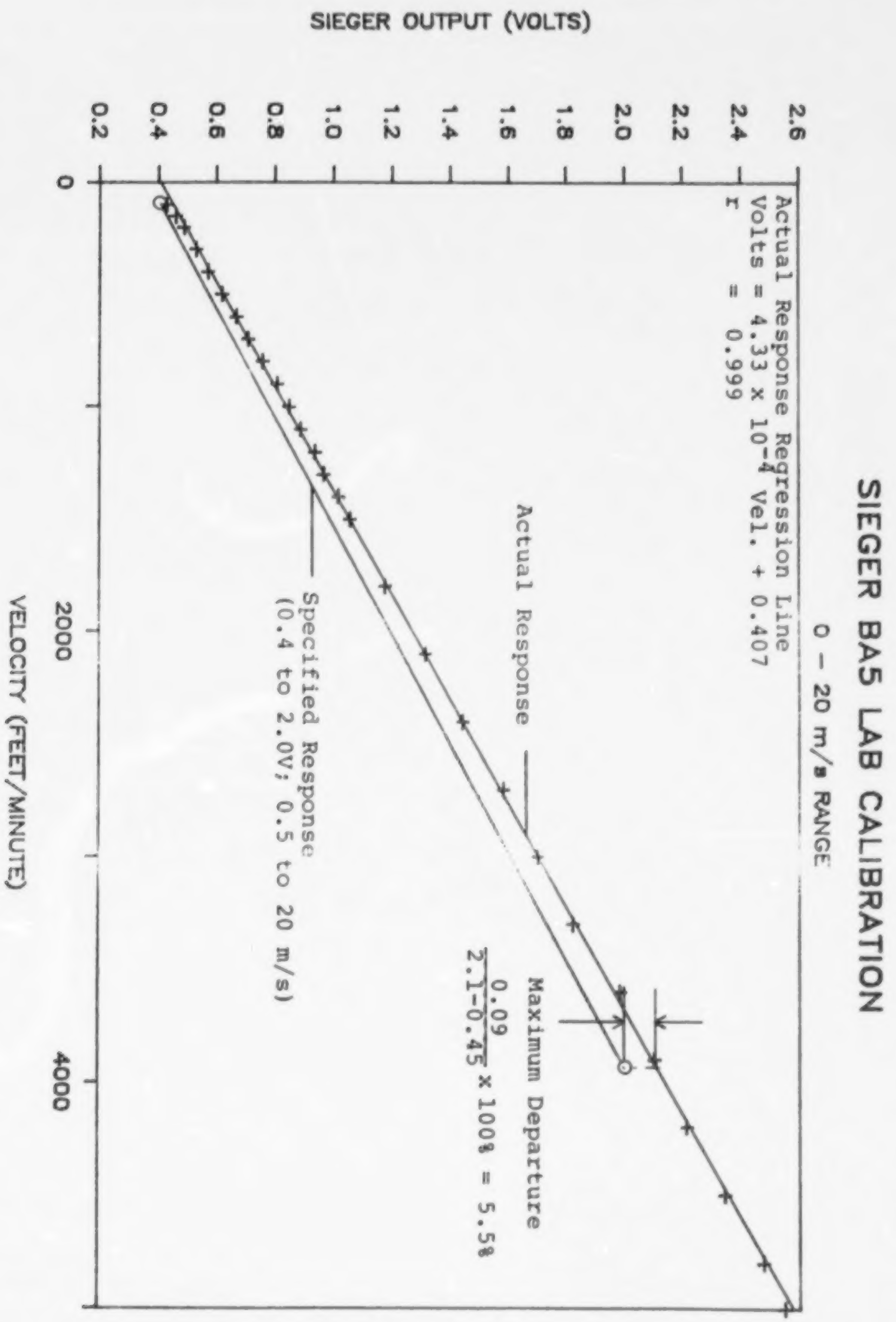


Figure 52: Effect of RC Time Constant

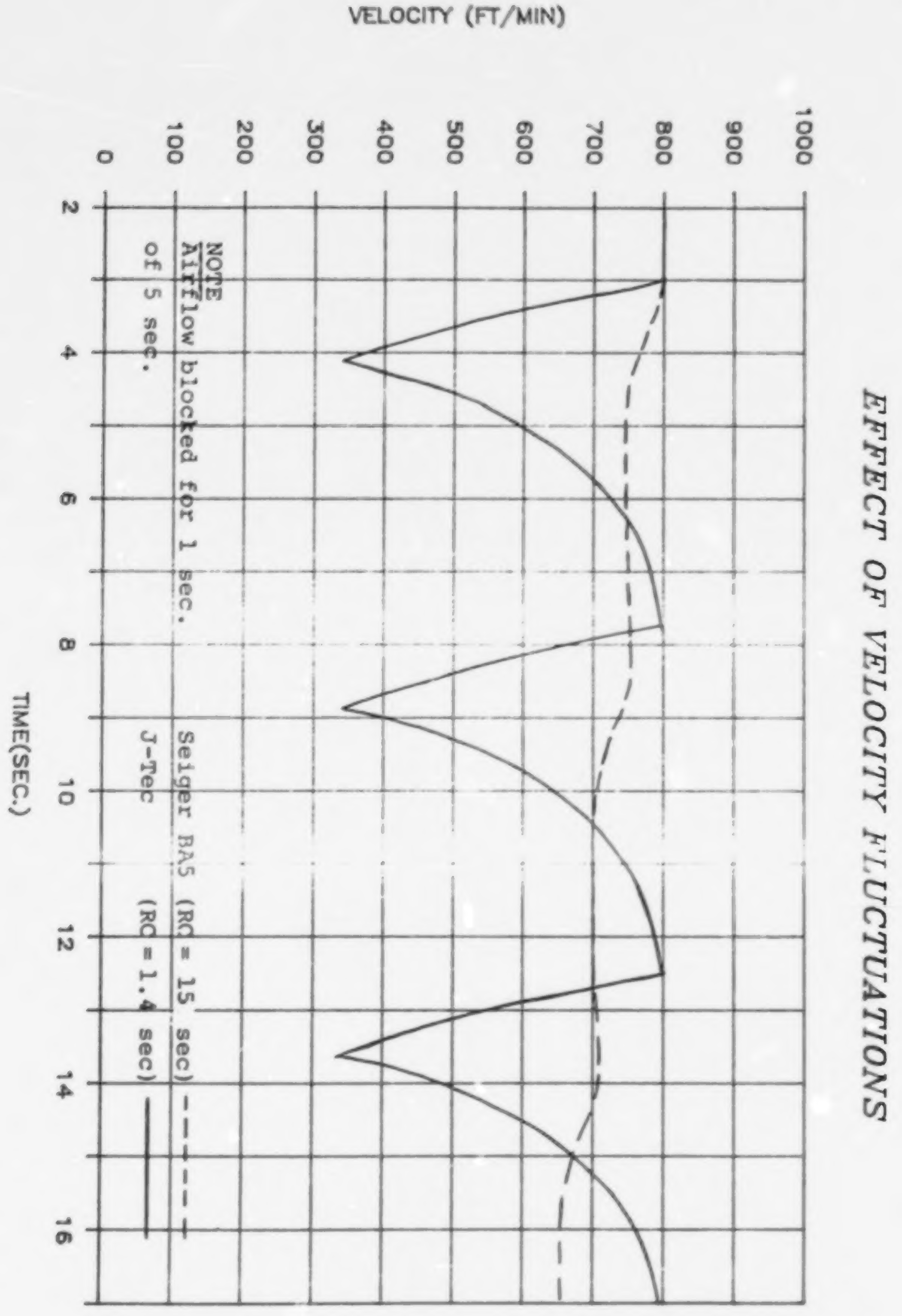


Figure 53: Trend Plot for 9 East Coal Road Methane (Aug 27-29/86)

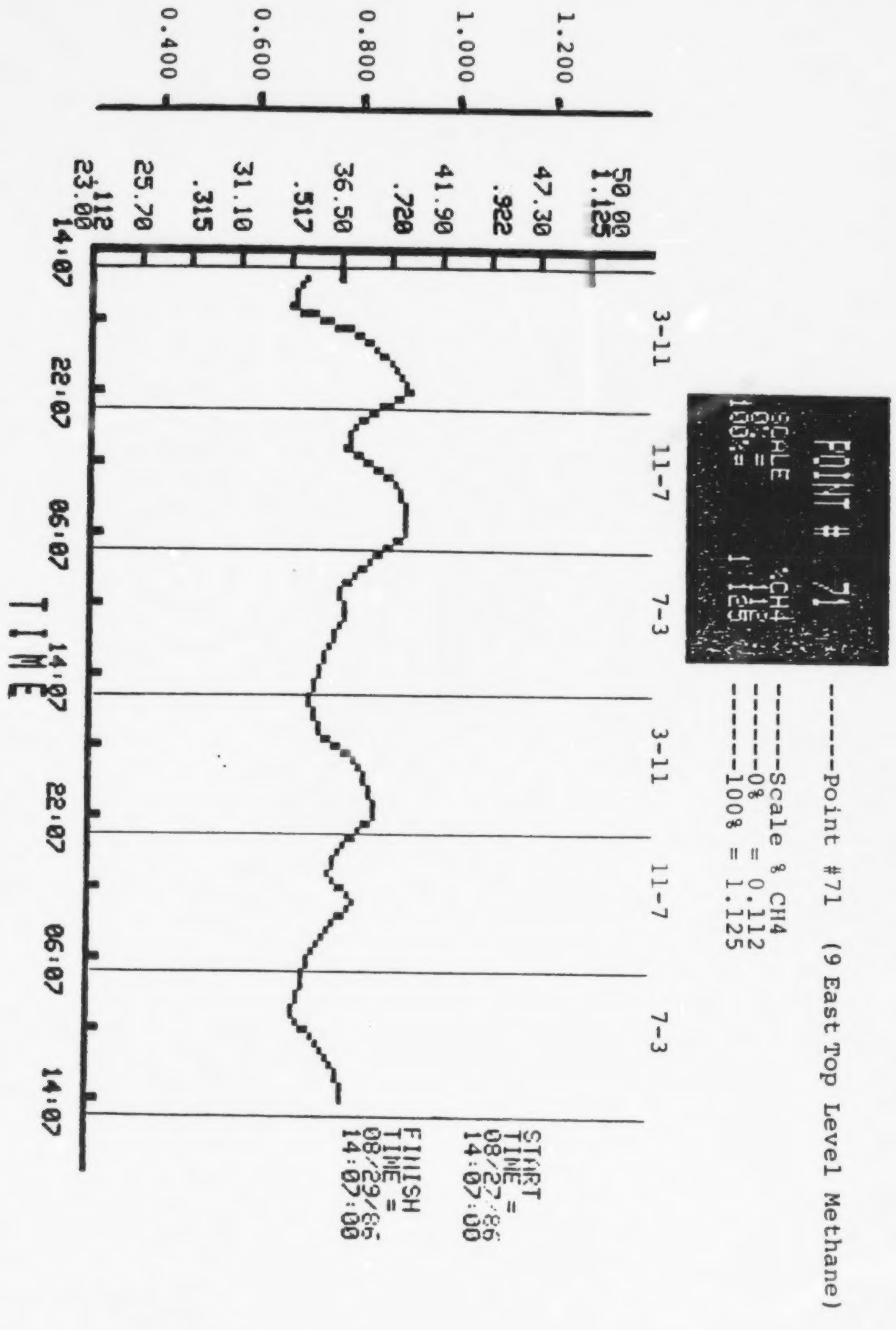


Figure 54: Trend Plot for 9 East Coal Road Methane (Aug. 27-29/86)

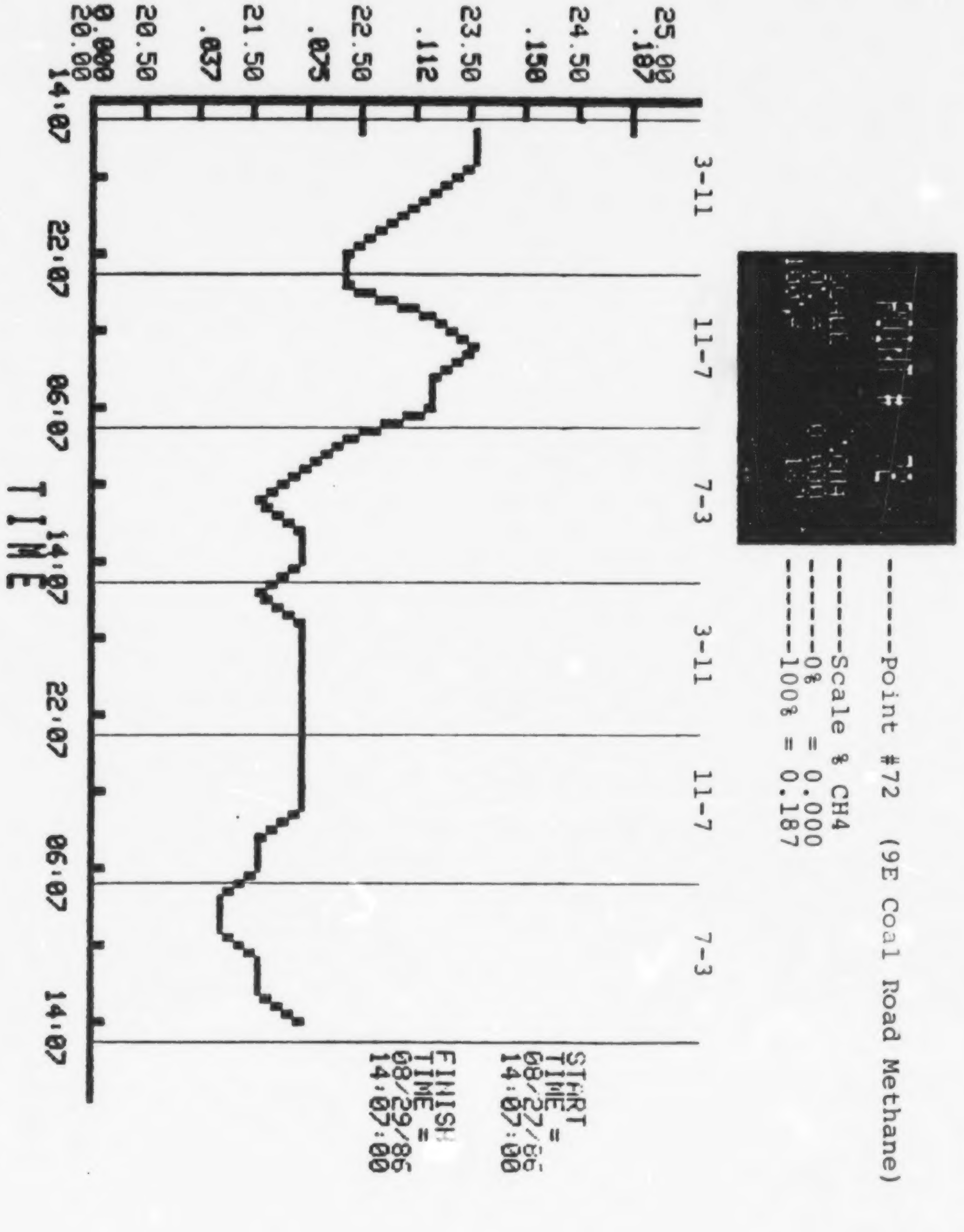


Figure 55: Trend Plot for 9 East Top Level Air Flow (Aug 27-29/86)

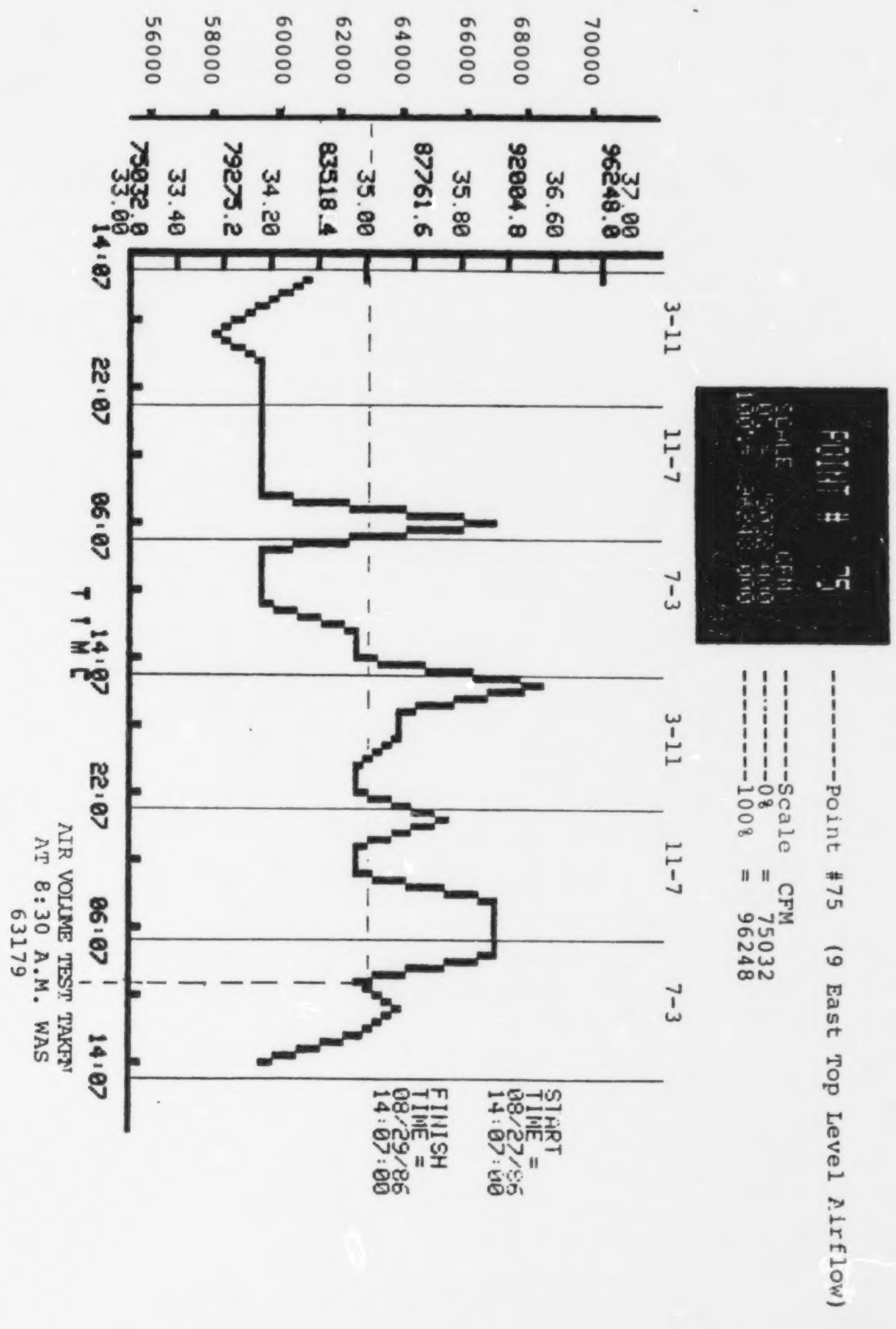


Figure 56: Trend Plot for 9 East Methane Drainage Volume (Aug 27-29/86)

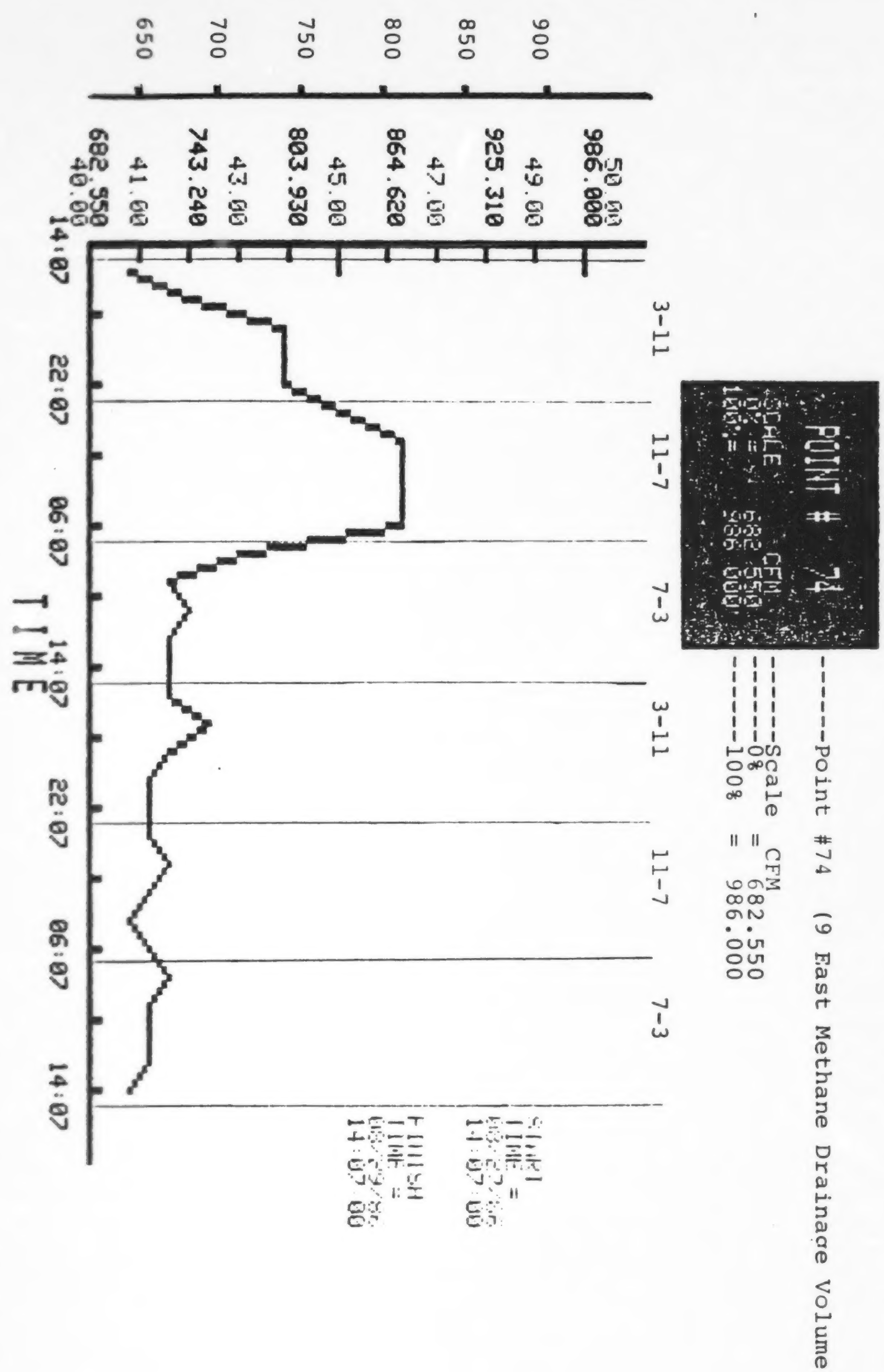
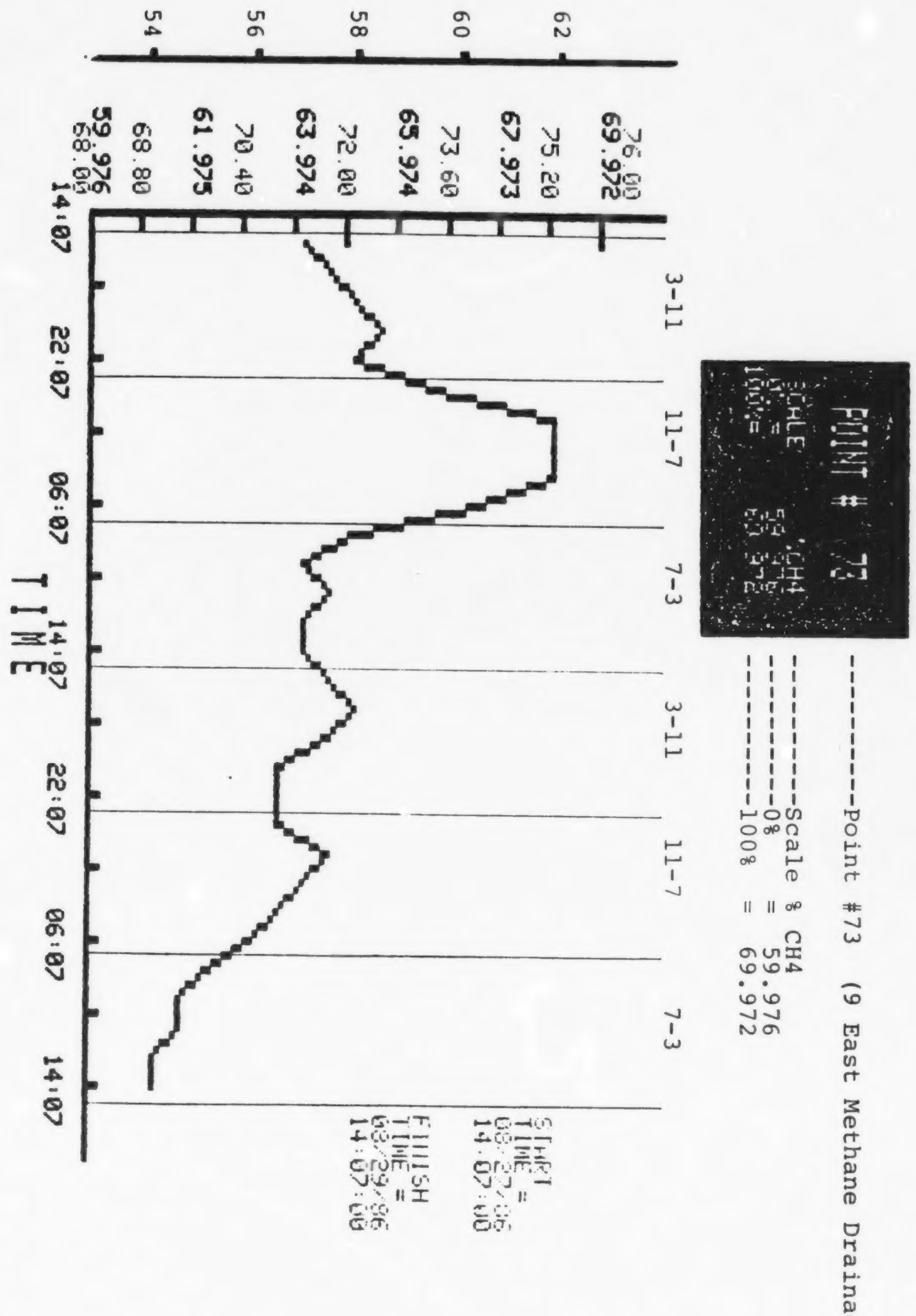


Figure 57: Trend Plot for 9 East Methane Drainage Concentration (Aug 27-29/86)



# Tables

Table 1: Summary of Main Transducer Types in Lingan

| PARAMETER | TRANSDUCER | MANUFACTURER | RANGE | UNITS | APPROX. ACCURACY | OUTPUT |
|---|---|---|---|---|---|---|
| Ventilation air velocity | VA216B | J-Tec | 50-3000 | F.P.M. | ±2% F.S. | 4-20 mA.d.c. |
| % CH4 in ventilation air | BM1 | Sieger | 0-3 | % CH4 | ±0.1% CH4 | 0.4 - 2.0 v.d.c. |
| Methane Drainage Flow | VF581-8B | J-Tec | 125-2100 | CFM | ±2% F.S. | 4-20 mA.d.c. |
| % CH4 in Methane Drainage | BM2H | Sieger | 0-100 | % CH4 | ±3% CH4 | 0.4-2.0 v.d.c. |
| Carbon Monoxide in vent. air | P1212 | Conspec | 0-50 | PPM | ±2% F.S. | 0-1v.d.c. |
| Barometric Pressure | E13DM | Foxboro | 98-104 | kPa | ±0.5% | 4-20 mA.d.d. |
| Ambient Temperature | RTD | Chromolox | -34 to 65 | °C | ±0.5°C | 100 ohms at 0°C |
| Water gauge | 823DP | Foxboro | 0-30 | in H20 | ±0.2% | 4-20 mA.d.c. |
| Water Level | 8010 | KDG | 0-4 | m | ±1.5% F.S. | 4-20 mA.d.c. |
| Water Pressure | 6320 | KDG | 0-500 | PSI | ±0.5% F.S. | 4-20 mA.d.c. |
| Water Flow | BQ7 | Bailey | 0-2000 | GPM | ±0.25% F.S. | 4-20 mA.d.c. |
| Bearing Temperature Switch | TC10 | Trolex | 20-80 | °C | ±1°C | open/closed |
| Vibration Protection Switch | 3171 | Inertia | 1-9 | g | -- | open/closed |
| Contractor Status Switch | NPT1 | Baldwin Francis | -- | open/cosed | -- | Voltage Free contact |
| Earth Leakage Status Switch | NPT1 | Baldwin Francis | -- | ok/alarm | -- | Voltage Free contact |
| Overload Status Switch | NPT1 | Baldwin Francis | -- | ok/alarm | -- | Voltage Free contact |
| Motor Current | NPT1 | Baldwin Francis | 0-300 | % | -- | 0.4 to 2.0 V.D.C. |

## Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING

TRUNK: 1

OUTSTATION: Main Fan

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES | |
|---|---|---|---|---|---|
| | | | | START | STOP |
| PRESSURE | Fan Water Gauge | "H2O | 101 | Jul/84 | Oct/86 |
| PRESSURE | Barometer | "Hg | 102 | Jul/84 | Oct/86 |
| J-Tec | Cross-cut from 2 Deep to Fan Shaft | CFM | 103 | Jul/84 | Oct/86 |
| J-Tec | 1 Deep 50 feet below Fan Shaft | CFM | 104 | Jul/84 | Oct/86 |
| J-Tec | 4 Deep Airflow (Temporary Fans) | CFM | 400 | Jul/86 | Aug/86 |
| TEMPERATURE | North Side of Fan House | °C | 107 | Jul/84 | Oct/86 |
| BM1 | Top of Fan Shaft | % CH4 | 108 | Jul/84 | Oct/86 |
| BM1 | 2 Deep Methane | % CH4 | 402 | Jul/84 | Aug/86 |
| CO | Carbon Monoxide - Top of Fan Shaft | PPM | 109 | Mar/85 | Mar/86 |
| BINARY (5) | Fan Motor Temperature | Normal/Alarm | 91 | Jul/84 | Oct/86 |
| BINARY (5) | Fan Motor Vibration | Normal/Alarm | 92 | Jul/84 | Oct/86 |
| BINARY (5) | Fan Bearing Vibration | Normal/Alarm | 94 | Jul/84 | Oct/86 |
| BINARY (5) | 4 Deep Temporary Surface Fans | Normal/Alarm | 401 | Jul/86 | Aug/86 |
| BINARY (7) | Hoist Room Top Door Closed Alert | Normal/Alarm | 80 | Jul/86 | Aug/86 |
| BINARY (7) | Hoist Room Top Door Open Alert | Normal/Alarm | 81 | May/86 | Oct/86 |
| BINARY (7) | Hoist Room Bottom Door Closed Alert | Normal/Alarm | 82 | May/86 | Oct/86 |
| BINARY (7) | Hoist Room Bottom Door Open Alert | Normal/Alarm | 83 | May/86 | Oct/86 |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 1

OUTSTATION: Extraction Plant

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES | |
|---|---|---|---|---|---|
| | | | | START | STOP |
| BM2H | Surface Inlet Side of Extraction Plant | % CH4 | 300 | May/85 | Jul/86 |
| PRESSURE | Extraction Plant Suction | % | 301 | May/85 | Jul/86 |
| DIFF. PRESS. | Extraction Plant Inlet Flow | CMS | 302 | May/85 | Jul/86 |
| BINARY (6) | Extraction Plant Atmospheric CH4 | Normal/Alarm | 303 | May/85 | Jul/86 |
| BINARY (6) | Extraction Plant Instrument Panel | Normal/Alarm | 304 | May/85 | Jul/86 |
| BINARY (6) | Extraction Plant Control Panel | Normal/Alarm | 305 | May/85 | Jul/86 |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 1

OUTSTATION: 8 East Longwall

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES START | SERVICE DATES STOP |
|---|---|---|---|---|---|
| BM1 | 8 East Top Level 20 feet inbye cundy | % CH4 | 011 | Jun/84 | Mar/85 |
| BM1 | 8 East Coal Road at Fire Seal | % CH4 | 012 | Jun/84 | Sept/86 |
| BM1 | 8 East Top Level 100 feet inbye cundy | % CH4 | 011 | Mar/85 | Sept/86 |
| BM2H | 8 East Methane Drainage (0-100%) | % CH4 | 013 | Jun/84 | Aug/86 |
| J-Tec(Pipe) | 8 East Methane Drainage Flow | CFM | 014 | Jun/84 | Aug/86 |
| J-Tec | 8 East Top Level at Fire Seal | CFM | 015 | Jun/84 | Aug/86 |
| J-Tec | 8 East Coal Road at Fire Seal | CFM | 016 | Jun/84 | Aug/86 |
| J-Tec | 8 East Top Level 300 feet outbye cundy | CFM | 017 | Mar/85 | Aug/86 |
| J-Tec | 8 East Top Level 50 feet inbye cundy | CFM | 018 | Mar/85 | Aug/86 |

## Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 1

OUTSTATION: 9 East Longwall

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES START | STOP |
|---|---|---|---|---|---|
| BM1 | 8 East Top Level at Fire Seal | % CH4 | 011 | Oct/86 | Oct/86 |
| BM1 | 8 East Top Level at Fire Seal | % CH4 | 203 | Oct/86 | |
| BM1 | 8 East Coal Road at Fire Seal | % CH4 | 012 | Oct/86 | Oct/86 |
| BM1 | 8 East Coal Road at Fire Seal | % CH4 | 200 | Oct/86 | |
| BM1 | 9 East Top Level at Fire Seal | % CH4 | 071 | Jul/84 | Jan/87 |
| BM1 | 9 East Top Level 20 feet inbye Cundy | % CH4 | 071 | Jan/87 | |
| BM1 | 9 East Coal Road at Fire Seal | % CH4 | 072 | Jul/84 | |
| BM1 | 10 East Top Level at Fire Seal | % CH4 | 203 | Apr/86 | Oct/86 |
| BM1 | 10 East Coal Road at Fire Seal | % CH4 | 200 | Apr/86 | Oct/86 |
| BM2H | 9 East Methane Drainage (CH4) | % CH4 | 073 | Jul/84 | |
| J-Tec (Pipe) | 9 East Methane Drainage Flow | CFM | 074 | Jul/84 | |
| J-Tec | 9 East Top Level at Fire Seal | CFM | 075 | Jul/84 | |
| J-Tec | 9 East Coal Road at Fire Seal | CFM | 076 | Jul/84 | |
| BINARY (5) | 2 Deep above Top 9 East Top Door Closed | Closed/Open | 067 | Apr/86 | |
| BINARY (5) | 2 Deep Above Top 9 East Top Door Open | Closed/Open | 068 | Apr/86 | |
| BINARY (5) | 2 Deep Above Top 9 East Bottom Door Closed | Closed/Open | 069 | Apr/86 | |
| BINARY (5) | 2 Deep Above Top 9 East Bottom Door Open | Closed/open | 070 | Apr/86 | |

## Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 1

OUTSTATION: 10 East Longwall

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES | |
|---|---|---|---|---|---|
| | | | | START | STOP |
| BM1 | 10 East Top Level at Fire Seal | % $CH_4$ | 011 | Oct/86 | |
| BM1 | 10 East Coal Road at Fire Seal | % $CH_4$ | 012 | Oct/86 | |
| BM2H | 10 East Methane Drainage (0-100%) | % $CH_4$ | 201 | Sept/86 | Oct/86 |
| BM2H | 10 East Methane Drainage (0-100%) | % $CH_4$ | 013 | Oct/86 | |
| J-Tec (Pipe) | 10 East Methane Drainage Flow | CFM | 202 | Sept/86 | Oct/86 |
| J-Tec (Pipe) | 10 East Methane Drainage Flow | CFM | 014 | Oct/86 | |
| J-Tec | 10 East Top Level at Fire Seal | CFM | 015 | Nov/86 | |
| J-Tec | 10 East Coal Road at Fire Seal | CFM | 016 | Nov/86 | |

## Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 1 OUTSTATION: 6 West Longwall

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES | |
|---|---|---|---|---|---|
| | | | | START | STOP |
| BM1 | 6 West Top Level at Fire Seal | % CH4 | 041 | Jul/85 | |
| BM1 | 6 West Coal Road at Fire Seal | % CH4 | 042 | Jul/85 | |
| BM1 | 7 West Top Level at Fire Seal | % CH4 | 051 | May/87 | |
| BM2H | 6 West Methane Drainage (0-100%) | % CH4 | 043 | Jul/85 | |
| J-Tec (Pipe) | 6 West Methane Drainage Flow | CFM | 044 | Jul/85 | |
| J-Tec | 6 West Top Level at Fire Seal | CFM | 045 | Jul/85 | |
| J-Tec | 6 West Coal Road at Fire Seal | CFM | 046 | Jul/85 | |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 2

OUTSTATION: 9 East Canmet Station

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES |  |
|---|---|---|---|---|---|
|  |  |  |  | START | STOP |
| BM1 | Top Level 450 m inbye 5 Slope | % CH4 | 350 | Jun/86 | Mar/87 |
| BM1 | Top Level 940 m inbye 5 Slope | % CH4 | 351 | Jun/86 | Apr/87 |
| BM1 | Top Level 1400 m inbye 5 Slope | % CH4 | 352 | Jun/86 | Apr/87 |
| BM1 | Top Level 100 m outbye cundy | % CH4 | 353 | Jan/87 |  |
| BM1 | Bottom Level 1545 m inbye 5 Slope | % CH4 | 355 | Jun/86 | Apr/87 |
| BM1 | Top Level at Fire Seal | % CH4 | 363 | Apr/87 |  |
| BM1 | Top Level 460 m inbye cundy | % CH4 | 364 | Apr/87 |  |
| BM1 | Bottom Level 1940 m inbye 5 Slope | % CH4 | 365 | Apr/87 |  |
| J-Tec | Top Level 140 m outbye cundy | CFM | 077 | Mar/87 |  |
| J-Tec | Top Level 15 m inbye cundy | CFM | 078 | Mar/87 |  |
| J-Tec | Top Level 450 m inbye 5 Slope | CFM | 356 | Jun/86 | May/87 |
| J-Tec | Top Level 940 m inbye 5 Slope | CFM | 357 | Jun/86 | Mar/87 |
| J-Tec | Top Level 1350 m inbye 5 Slope | CFM | 358 | Jun/86 | Mar/87 |
| J-Tec | Bottom Level 1545 m inbye 5 Slope | CFM | 361 | Jun/86 |  |
| J-Tec | Top Level 460 m inbye cundy | CFM | 366 | Apr/87 |  |
| Trolex | Top Level 450 m inbye 5 Slope | CFM | 362 | Mar/86 | May/87 |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 3

OUTSTATION: 4 Cross-cut Pump Station

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES | |
|---|---|---|---|---|---|
| | | | | START | STOP |
| BINARY (5) | #1 Pump Vibration | Normal/Alarm | 128 | Mar/87 | |
| BINARY (5) | #2 Pump Vibration | Normal/Alarm | 130 | Jan/87 | |
| BINARY (5) | #2 Pump Temperature | Normal/Alarm | 129 | Mar/87 | |
| BINARY (7) | Auto Start #1 Pump | -- | 140 | Feb/87 | |
| PRESSURE | Pump Discharge Pressure | Psi | 131 | Feb/87 | |
| DIFF. PRES. | Pump Water Flow | GMP | 132 | Mar/87 | |
| PRESSURE | Lodgement Water Level | METERS | 133 | Mar/87 | |
| PRESSURE | Mine Fresh Water Intake | GMP | 136 | Jul/87 | |
| PRESSURE | Mine Fresh Water Intake (Weekend) | GMP | 137 | Jan/87 | |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 3

OUTSTATION: 3 East Pump Station

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES | |
|---|---|---|---|---|---|
| | | | | START | STOP |
| Pressure | Lodgement Water Level | Meters | 163 | July/86 | Oct/86 |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 3

OUTSTATION: 6 Drive Pump Station

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES START | SERVICE DATES STOP |
|---|---|---|---|---|---|
| BINARY (5) | #1 Pump Temperature | Alarm/Normal | 187 | Jul/86 | Aug/86 |
| BINARY (5) | #1 Pump Temperature | Alarm/Normal | 187 | Jan/87 | Apr/87 |
| BINARY (5) | #2 Pump Temperature | Alarm/Normal | 189 | Jul/86 | Sep/86 |
| BINARY (5) | #1 Pump Vibration | Alarm/Normal | 188 | Jul/86 | Sep/86 |
| BINARY (5) | #2 Pump Vibration | Alarm/Normal | 190 | Jul/86 | Sep/86 |
| PRESSURE | Pump Discharge Pressure | PSI | 191 | Jul/86 | Apr/87 |
| DIFF. PRES. | Pump Water Flow | GPM | 192 | Jul/86 | Aug/86 |
| DIFF. PRES. | Pump Water Flow | GPM | 192 | Jan/87 | Apr/87 |
| PRESSURE | Lodgement Water Level | METERS | 193 | Jul/86 | Apr/87 |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 4

OUTSTATION: Main Fan

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES START | STOP |
|---|---|---|---|---|---|
| PRESSURE | Fan Water Gauge | "H2O | 101 | Oct/86 | Apr/87 |
| PRESSURE | Fan Water Gauge | "H2O | 216 | Apr/87 | |
| PRESSURE | Barometer | "Hg | 102 | Oct/86 | Apr/87 |
| PRESSURE | Barometer | "Hg | 217 | Apr/87 | |
| J-Tec | Cross-cut from 2 Deep to Fan Shaft | CFM | 103 | Oct/86 | Apr/87 |
| J-Tec | Cross-cut from 2 Deep to Fan Shaft | CFM | 218 | Apr/87 | |
| J-Tec | 1 Deep 50 feet Below Fan Shaft | CFM | 104 | Oct/86 | Apr/87 |
| J-Tec | 1 Deep 50 feet Below Fan Shaft | CFM | 219 | Apr/87 | |
| TEMPERATURE | North Side of Fan House | °C | 107 | Oct/86 | Apr/87 |
| TEMPERATURE | North Side of Fan House | °C | 222 | Apr/87 | |
| BM1 | Top of Fan Shaft | % CH4 | 108 | Oct/86 | Apr/87 |
| BM1 | Top of Fan Shaft | % CH4 | 225 | Apr/87 | |
| BM1 | 2 Deep 30 feet Below Fan Shaft | % CH4 | 109 | Dec/86 | Apr/87 |
| BM1 | 2 Deep 30 feet Below Fan Shaft | % CH4 | 231 | Apr/87 | |
| BINARY (5) | Fan Motor Temperature | Alarm/Normal | 91 | Oct/86 | Apr/87 |
| BINARY (5) | Fan Motor Vibration | Alarm/Normal | 92 | Oct/86 | Apr/87 |
| BINARY (5) | Fan Bearing Vibration | Alarm/Normal | 94 | Oct/86 | Apr/87 |
| BINARY (5) | Compressor Fire Alarm (Fan House) | Alarm/Normal | 210 | Apr/87 | |
| BINARY (5) | Fan Fire Alarm | Alarm/Normal | 211 | Apr/87 | |
| BINARY (5) | Fan House Fire Suppression System | Alarm/Normal | 212 | Apr/87 | |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 4

OUTSTATION: Main Fan

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES START | STOP |
|---|---|---|---|---|---|
| BINARY (5) | Fan House Water Sprinkler Pressure | Alarm/Normal | 213 | Apr/87 | |
| BINARY (5) | Fan House "Fire Alarm Trouble" | Alarm/Normal | 215 | Apr/87 | |
| PRESSURE | Fan House Compressor Discharge Pressure | P.S.I. | 220 | Apr/87 | |
| TEMPERATURE | Fan House Compressor Discharge Temperature | °C | 221 | Apr/87 | |
| AMPERAGE | Fan Motor Current | AMPS | 223 | Apr/87 | |
| AMPERAGE | Fan House #1 Compr. Motor Current | AMPS | 226 | Apr/87 | |
| AMPERAGE | Fan House #2 Compr. Motor Current | AMPS | 227 | Apr/87 | |
| AMPERAGE | Fan House #3 Compr. Motor Current | AMPS | 228 | Apr/87 | |
| AMPERAGE | Fan House #4 Compr. Motor Current | AMPS | 229 | Apr/87 | |
| BINARY (6) | No. 1 Compr. Healthy | Alarm/Normal | 232 | Apr/87 | |
| BINARY (6) | No. 1 Compr. Status | Alarm/Normal | 233 | Apr/87 | |
| BINARY (6) | No. 1 Compr. Overload | Alarm/Normal | 234 | Apr/87 | |
| BINARY (6) | No. 1 Compr. Gnd. Flt. | Alarm/Normal | 235 | Apr/87 | |
| BINARY (6) | No. 1 Compr. Oil | Alarm/Normal | 236 | Apr/87 | |
| BINARY (6) | No. 1 Compr. Air Temp | Alarm/Normal | 237 | Apr/87 | |
| BINARY (6) | No. 1 Compr. Sequence | Alarm/Normal | 238 | Apr/87 | |
| BINARY (6) | No. 2 Compr. Sequence | Alarm/Normal | 239 | Apr/87 | |
| BINARY (6) | No. 2 Compr. Healthy | Alarm/Normal | 240 | Apr/87 | |
| BINARY (6) | No. 2 Compr. Status | Alarm/Normal | 241 | Apr/87 | |
| BINARY (6) | No. 2 Compr. Overload | Alarm/Normal | 242 | Apr/87 | |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 4

OUTSTATION: Main Fan

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES | |
|---|---|---|---|---|---|
| | | | | START | STOP |
| BINARY (6) | No. 2 Compr. GND FLT | Alarm/Normal | 243 | Apr/87 | |
| BINARY (6) | No. 2 Compr. Oil | Alarm/Normal | 244 | Apr/87 | |
| BINARY (6) | No. 2 Compr. Air Temp | Alarm/Normal | 245 | Apr/87 | |
| BINARY (6) | No. 3 Compr. Healthy | Alarm/Normal | 248 | Apr/87 | |
| BINARY (6) | No. 3 Compr. Status | Alarm/Normal | 249 | Apr/87 | |
| BINARY (6) | No. 3 Compr. Overload | Alarm/Normal | 250 | Apr/87 | |
| BINARY (6) | No. 3 Compr. GND FLT | Alarm/Normal | 251 | Apr/87 | |
| BINARY (6) | No. 3 Compr. Oil | Alarm/Normal | 260 | Apr/87 | |
| BINARY (6) | No. 3 Compr. Air Temp | Alarm/Normal | 261 | Apr/87 | |
| BINARY (6) | No. 3 Compr. Sequence | Alarm/Normal | 262 | Apr/87 | |
| BINARY (6) | No. 4 Compr. Sequence | Alarm/Normal | 263 | Apr/87 | |
| BINARY (6) | No. 4 Compr. Healthy | Alarm/Normal | 264 | Apr/87 | |
| BINARY (6) | No. 4 Compr. Status | Alarm/Normal | 265 | Apr/87 | |
| BINARY (6) | No. 4 Compr. Overload | Alarm/Normal | 266 | Apr/87 | |
| BINARY (6) | No. 4 Compr. GND Fault | Alarm/Normal | 267 | Apr/87 | |
| BINARY (6) | No. 4 Compr. Oil | Alarm/Normal | 268 | Apr/87 | |
| BINARY (6) | No. 4 Compr. Air Temp | Alarm/Normal | 269 | Apr/87 | |
| BINARY (6) | Fan Controller | Alarm/Normal | 252 | Apr/87 | |
| BINARY (6) | Oil Temperature/Pressure | Alarm/Normal | 253 | Apr/87 | |
| BINARY (6) | Oil Level/Pressure | Alarm/Normal | 254 | Apr/87 | |
| BINARY (6) | Bearing Vibration Alert | Alarm/Normal | 255 | Apr/87 | |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 4

OUTSTATION: Main Fan

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES | |
|---|---|---|---|---|---|
| | | | | START | STOP |
| BINARY (6) | Bearing Vibration High | Alarm/Normal | 256 | Apr/87 | |
| BINARY (6) | Bearing Temperature Alert | Alarm/Normal | 257 | Apr/87 | |
| BINARY (6) | Bearing Temperature High | Alarm/Normal | 258 | Apr/87 | |
| BINARY (6) | Fan Brake Position | Alarm/Normal | 259 | Apr/87 | |
| BINARY (6) | Fan Motor GND Fault | Alarm/Normal | 270 | Apr/87 | |
| BINARY (6) | Fan Motor Overload and Phase Imbalance | Alarm/Normal | 271 | Apr/87 | |
| BINARY COMM 7 | No. 1 Compr. Start | -- | 278 | Apr/87 | |
| BINARY COMM 7 | No. 1 Compr. Stop | -- | 279 | Apr/87 | |
| BINARY COMM 7 | No. 2 Compr. Start | -- | 272 | Apr/87 | |
| BINARY COMM 7 | No. 2 Compr. Stop | -- | 273 | Apr/87 | |
| BINARY COMM 7 | No. 3 Compr. Start | -- | 274 | Apr/87 | |
| BINARY COMM 7 | No. 3 Compr. Stop | -- | 275 | Apr/87 | |
| BINARY COMM 7 | No. 4 Compr. Start | -- | 276 | Apr/87 | |
| BINARY COMM 7 | No. 4 Compr. Stop | -- | 277 | Apr/87 | |
| BINARY COMM 7 | Fan Remote Stop | -- | 281 | Apr/87 | |
| BINARY COMM 7 | Hoist Room Top Door Closed Alert | Open/Closed | 080 | Oct/87 | |
| BINARY COMM 7 | Hoist Room Top Door Open Alert | Open/Closed | 081 | Oct/87 | |
| BINARY COMM 7 | Hoist Room Bottom Door Closed Alert | Open/Closed | 082 | Oct/87 | |
| BINARY COMM 7 | Hoist Room Bottom Door Open Alert | Open/Closed | 083 | Oct/87 | |

Table 2: LIST OF OPERATIONAL TRANSDUCERS - LINGAN REMOTE MONITORING (cont)

TRUNK: 4

OUTSTATION: Extraction Plant

| TRANS. TYPE | LOCATION | UNITS | POINT NO. | SERVICE DATES |  |
|---|---|---|---|---|---|
|  |  |  |  | START | STOP |
| BM2H | Surface Inlet Side of Extraction Plant | % CH4 | 300 | Jul/87 | Apr/87 |
| BM2H | Surface Inlet Side of Extraction Plant | % CH4 | 448 | Apr/87 |  |
| PRESSURE | Extraction Plant Suction | % | 301 | Jul/87 | Apr/87 |
| PRESSURE | Extraction Plant Suction | % | 450 | Apr/87 |  |
| DIFF. PRES. | Extraction Plant Inlet Flow | $M^3/s$ | 302 | Jul/87 | Apr/87 |
| DIFF. PRES. | Extraction Plant Inlet Flow | $M^3/s$ | 449 | Apr/87 |  |
| BINARY (5) | Extraction Plant Atmospheric CH4 | Normal/Alarm | 303 | Jul/87 | Apr/87 |
| BINARY (6) | Extraction Plant Atmospheric CH4 | Normal/Alarm | 437 | Apr/87 |  |
| BINARY (5) | Extraction Plant Instrument Panel | Normal/Alarm | 304 | Jul/87 | Apr/87 |
| BINARY (6) | Extraction Plant Instrument Panel | Normal/Alarm | 438 | Apr/87 |  |
| BINARY (5) | Extraction Plant Control Panel | Normal/Alarm | 305 | Jul/87 | Apr/87 |
| BINARY (6) | Extraction Plant Huwood Control Panel | Normal/Alarm | 439 | Apr/87 |  |

## Table 3: Summary of System Commands for The Senturion 200

### A) Sign On/Off, Troubleshooting:

| | |
|---|---|
| EAC | Enter/Change access code |
| TTT | Terminate Operator Access |
| IDN | Identify Hardware Configuration |
| DMP | Dump memory |

### B) System Entry/Modification

| | |
|---|---|
| CAP | Change Analog Parameters |
| CFI | Enter Correction Factor |
| DSE | Description Entry Change |
| EDS | Edit Accessor Scan |
| KIL | Delete (Kill) Accessor |
| LTT | Enter Trend Log Data |
| NEW | Enter New Accessor Data |
| OFS | Enter Offset |

### C) Disk Operation

| | |
|---|---|
| FMT | Format Disk |
| RDS | Read Status Disk |
| SVD | Save Status on Disk |

### D) CRT Display

| | |
|---|---|
| CRT | Clear Screen |
| CS1 - CS6 | Continuous Status Display |
| ISR | Immediate Status Report |
| ROL | Auto - roll |
| STT | Set Time |
| STD | Set Date |

### E) Commandable Points

| | |
|---|---|
| COC | Control command (binary) |
| CPA | Control Point Adjust (analog) |
| RPA | Reset Pulse Accumulator |

### F) Print Reports

| | |
|---|---|
| ACC | Accessor Scan List |
| ALP | All Points Log |
| ALS | Alarm Summary |
| DSS | Descriptor List |
| FLP | Free Line Printer |
| PAP | Print Analog Parameters |
| PCO | Print Correction Factor and Offset Table |
| PSS | Printer Select |
| Time/Date | Print Current Time and Date |

## Table 3: Summary of System Commands for the Senturion 200 (cont)

### G) Shift Reports

| | |
|---|---|
| LPT | Set Last Point Number |
| SPN | Shift Report Point Number |
| TSR | Time of Shift Report |
| REQ | Request Current Shift Report |
| PSR | Print 1 of 3 Current Shift Reports |
| OLR | Print old Shift Report from Disk |
| RSV | Save Shift Report on Disk |

### H) Special Keys for Data Entry

| | |
|---|---|
| CANCEL/ESCAPE | Abort any command in progress |
| EXECUTE/RETURN | Enter the preceeding data |
| DELETE (DEL) | Backspace to allow re-entry |
| SKIP/LINE FEED | Skip data for which no change |

### I) Special Keys for Alarm Handling

| | |
|---|---|
| HOME | Acknowledges on Alarm |
| SILENCE | Silences the horn (key located under desk) |
| CURSOR UP (↑) | Moves the cursor up |
| CURSOR DOWN (↓) | Moves the cursor down |
| CLEAR | Clears line if all alarms acknowledged |

Table 4: Outline of Lingan Installation Schedule

| ACTIVITY | COMPLETION DATE | MONTHS OVERDUE |
|---|---|---|
| No. 26 Transmitton system substantially complete | Jan/82 | -- |
| CANMET recommends Conspec System for Lingan | March/82 | -- |
| No. 26 Transmitton system commissioned | May/82 | -- |
| Specifications for Lingan system written | June/82 | -- |
| Review of Suitable systems | Sept/82 | -- |
| Tenders close | Nov/82 | -- |
| Review of Tenders and decision to buy Conspec system | June/83 | -- |
| Purchase order to Conspec | Sept/83 | -- |
| Conspec Equipment Delivery | April/84 | 3 |
| Other Equipment Delivery | June/84 | 2 |
| Wall Outstations | June/84 | 2 |
| Central Monitoring Station | June/84 | 2 |
| Pumping Station Outstations | Dec/84 | 8 |
| Commissioning | April/86 | 24 |

Table 5: Summary of Main Transducer Types in No. 26

| PARAMETER | TRANSDUCER | MANUFACTURER | RANGE | UNITS | APPROX. ACCURACY | OUTPUT |
|---|---|---|---|---|---|---|
| Ventilation air velocity | VA-216 | J-Tec | 50-3000 | F.P.M. | ±2% F.S. | 4-20 mA.d.c. |
| % CH4 in ventilation air | BM1 | Sieger | 0-3 | % CH4 | ±0.1% CH4 | 0.4-2.0V.d.c. |
| Methane drainage flow | VF581-8B | J-Tec | 62-2500 | F.P.M. | ±2% F.S. | 4-20 mA.d.c. |
| % CH4 in methane drainage | BM2H | Sieger | 0-100 | % CH4 | ±3% CH4 | 0.4-2.0V.d.c. |
| Barometric pressure | 2408-20B | Bristol | 30-179 | kPa | ±0.2% Span | 4-20 mA.d.c. |
| Ambient Temperature | RTD | Chromolox | 0-40 | °C | ±0.5°C | 100 ohms at 0°C |
| Water gauge | BQ7 | Bailey | 5-30 | in. H20 | ±0.25% Span | 4-20 mA.d.c. |
| Bearing Temperature switch | Tc10 | Trolex | 20-80 | °C | ±1°C | Open/closed |
| Bearing Temperature switch | Tc20 | Trolex | 10-85 | °C | ±5°C | Open/closed |
| Fluid Temperature switch | Tx200 | Trolex | 50-150 | °C | °5°C | Open/closed |
| Vibration Protection switch | 3171 | Inertia | 1-9 | g | -- | Open/closed |
| Motor Current | VCE-20 | Rochester |  |  |  |  |

## Table 6: Distribution of Transducers by Outstation

OUTSTATION LOCATION: 13 South Wall
OUTSTATION ADDRESS: A01
OUTSTATION TYPE: E01

**ANALOGUE INPUTS:**

1. BM1 Coal Road (BM1 BOT)
2. BM1 Cundy Hole (BM1 TOP)
3. BM2H Methane Drainage (BM2H)
4. J-Tec Methane Drainage (GAS FLOW)
5. J-Tec Material Road (MAT. ROAD)
6. J-Tec Outbye Cundy
7. J-Tec Inbye Cundy (IN CUNDY)
8. J-Tec Coal Road (COAL RD.)

**DIGITAL INPUTS:**

1. High Vacuum
2. Low Vacuum
3. Spare
4. Spare
5. Undg. AC Fail
6. Common Fault
7. Spare
8. Spare
9. Spare

OUTSTATION LOCATION: 13 North Wall
OUTSTATION ADDRESS: A02
OUTSTATION TYPE: E01

**ANALOGUE INPUTS:**

1. BM1 Coal Road (BM1 BOT)
2. BM1 Cundy Hole (BM1 TOP)
3. BM2H Methane Drainage (GAS FLOW)
4. J-Tec Methane Drainage (GAS FLOW)
5. J-Tec Material Road (MAT. ROAD)
6. J-Tec Outbye Cundy (OUTCUNDY)
7. J-Tec Inbye Cundy (IN CUNDY)
8. J-Tec Coal Road (COAL ROAD)

**DIGITAL INPUTS:**

1. High Vacuum
2. Low Vacuum
3. Spare
4. Spare
5. Undg. AC Fail
6. Common Fault
7. Spare
8. Spare
9. Spare

OUTSTATION LOCATION: Surface Fan
OUTSTATION ADDRESS: B01
OUTSTATION TYPE: E05

**ANALOGUE INPUTS:**

1. Spare
2. Spare
3. Spare
4. Spare
5. Ambient Air Temp. (AMB TEMP)
6. Barometer (BAROMETER)
7. Water Gauge (WATER GA)
8. J-Tec Air Shaft (AIRFLOW)

**DIGITAL INPUTS:**

1. Bearing Vibration
2. Bearing Temperature
3. Spare
4. Spare
5. AC Fail
6. Common Fault
7. Spare
8. Spare
9. Substation Alarm

### Table 6: Distribution of Transducers by Outstation (cont.)

OUTSTATION LOCATION: Main Booster Fan
OUTSTATION ADDRESS: B02
OUTSTATION TYPE: E04

| ANALOGUE INPUTS: | DIGITAL INPUTS: |
|---|---|
| 1. BM1 Room | 1. Motor Bearing Temp. |
| 2. BM1 Airway (BM1 AIR) | 2. Fan Bearing Temp. |
| 3. Spare | 3. Shaft Bearing Temp. |
| 4. Spare | 4. Motor Vibration |
| 5. Spare | 5. Undg. AC Fail |
| 6. Spare | 6. Common Fault |
| 7. Water Gauge (WATER GA) | 7. Breaker Tripped |
| 8. J-Tec Airway (AIR FLOW) | 8. Spare |
|  | 9. Fan Vibration |

OUTSTATION LOCATION: 10 North Booster Fan
OUTSTATION ADDRESS: B03
OUTSTATION TYPE: E02

| ANALOGUE INPUTS: | DIGITAL INPUTS: |
|---|---|
| 1. BM1 Room | 1. Motor Bearing Temp. |
| 2. BM1 Airway (BM1 AIR) | 2. Fan Bearing Temp. |
| 3. Spare | 3. Shaft Bearing Temp. |
| 4. Spare | 4. Motor Vibration |
| 5. Spare | 5. Undg. AC Fail |
| 6. Spare | 6. Common Fault |
| 7. Water Gauge (WATER GA) | 7. Scoop Coupling Temp. |
| 8. J-Tec Airway (AIR FLOW) | 8. Spare |
|  | 9. Fan Vibration |

OUTSTATION LOCATION: 9 South Booster Fan
OUTSTATION ADDRESS: B04
OUTSTATION TYPE: E03

| ANALOGUE INPUTS: | DIGITAL INPUTS: |
|---|---|
| 1. BM1 Room | 1. Motor Bearing Temp. |
| 2. BM1 Airway (BM1 AIR) | 2. Fan Bearing Temp. |
| 3. Spare | 3. Shaft Bearing Temp. |
| 4. Spare | 4. Motor Vibration |
| 5. Spare | 5. Undg. AC Fail |
| 6. Spare | 6. Common Fault |
| 7. Water Gauge (WATER GA) | 7. Spare |
| 8. J-Tec Airway (AIR FLOW) | 8. Gearbox Oil Temp. |
|  | 9. Fan Vibration |

## Table 7: Outline of No. 26 Installation Schedule

| ACTIVITY | COMPLETION DATE | MONTHS OVERDUE |
|---|---|---|
| Project definition with detailed Specifications | April/80 | -- |
| Purchase order to Transmitton | Dec./80 | -- |
| Transmitton equipment delivery | July/81 | -- |
| Other equipment delivery | July/81 | -- |
| Outstation Installation | Dec./81 | 5 |
| Central Monitoring Station | Dec./81 | 5 |
| Commissioning | May/82 | 10 |

Table 8: Comparison of No. 26 and Lingan Systems

| FEATURE | LINGAN (Conspec) | NO. 26 (Transmitton) | COMMENTS |
|---|---|---|---|
| A) **HARDWARE** | | | |
| Central Computer | Senturion 200 | Primary Computer | |
| -memory size (RAM) | 64K | 64K | |
| -software location | RAM | RAM | |
| -software backup | DISK* | Paper Tape | *256K capacity |
| -battery backup | 4 hrs. | 2 hrs. | |
| Graphics Computer | QUAY 910 | as above | |
| -memory size (RAM) | 208K* | as above | *Also has 10 meg hard disk |
| -software location | RAM | as above | |
| -software backup | DISK* | as above | *1.25 Meg. |
| -battery backup | as above | as above | |
| Computer Backup | NO | Fall back panel | |
| -memory size (RAM) | -- | 8k | |
| -software location | -- | PROM | |
| -battery backup | -- | NO | |
| I/O Devices | | | |
| -CRT Terminals (capacity/installed) | 5/3 | 5/1 | |
| -Printer Terminals | -- | 1 | |
| -Printers | 2 | as above | |
| -Color Printers | 1 | -- | |
| -Disk drive | 2 | -- | |
| -Paper tape reader | -- | 1 | |
| -Paper tape punch | -- | 1 | |
| -Meters | -- | 1* | *Fall back panel |
| -Chart recorders | -- | 2* | *Fall back panel |
| -Fall back panel | -- | 1 | |
| Trunks/Rings | 4 | 2 | |

Table 8: Comparison of No. 26 and Lingan Systems (cont.)

| FEATURE | LINGAN (Conspec) | NO. 26 (Transmitton) | COMMENTS |
|---|---|---|---|
| Outstation-capacity/ installed | 24/9 | 28/6 | |
| -independent status displayand control | yes | yes | |
| -tranducers (capacity/ installed) | 512/90 | 476/69 | |
| -remote accessor trunk lines | yes | no | |
| B) SOFTWARE | | | |
| -alarm monitoring configurable | yes | yes* | *Transmitton also has rate alarm |
| -audible alarms | yes | yes | |
| -continuous alarm display | 12 | 1* | *Up to 100 upon command |
| -continuous status display | 6 | 1* | *Up to 8 upon command |
| -command menu display | yes | commandable | |
| -alarm/event history log | continuously | commandable* | *up to 100 upon command |
| -shift report-points | 30 | -- | |
| -trend log-points | 10 | -- | |
| -graphical process displays | 256 | -- | |
| -trend plots (analogs) | 30 | All | Conspec up to 2 years.<br>Transmitton up to 7 days |
| -alarm instruction phrases | yes | -- | |
| -preventive maint. work orders | yes | -- | |
| -equipment stoppage analysis | yes | -- | |

Table 8: Comparison of No. 26 and Lingan Systems (cont.)

| FEATURE | LINGAN (Conspec) | NO. 26 (Transmitton) | COMMENTS |
|---|---|---|---|
| -logs of transducer groups | -- | yes | |
| -logs of outstation status | -- | yes | |
| C) COMMUNICATIONS | | | |
| -transmission distance | +9 km | +8 km | |
| -Baud rate | 4800 | 600 | |
| -Duplex mode | Full/half* | Full | *Less problems on full Duplex |
| -Modems required | yes* | No | *Very difficult to balance multiple modems |
| -scan time | 2.3 sec. | 21.6 sec | |
| D) OVERALL | | | |
| -EMR/CSA approvals | yes | yes | |
| -equipment delivery problems | major | none | |
| -commissioning problems | major | minor | |
| -software easy to use | no | yes | |
| -all software options work | no | yes | |
| -equipment reliability | poor | good | |
| -suitability to coal mines | poor | good | |

## TABLE 9: Comparison Of Jtec Calibration Methods

### PERFORMANCE SUMMARY

| Calib. Tech. | Point No. | Total Insp. | Avail. | Average Conspec Reading |  |  | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|---|
|  |  |  |  | Mean | STD | 95%CL |  |  |
| 'Devco' | 356,357 | 14 | 100% | 22154 | 2979 | 2131 | 25181 | -4905 |
| Hi/span | 356,357 | 15 | 93% | 24859 | 3126 | 2236 | 26400 | -3194 |

| Date | Calib. Tech. | Point No. | Conspec Reading |  |  | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
|  |  |  | Mean | STD | 95%CL |  |  |  |
| Jan12/87 | Hi/span | 356 | 24002 | 2747 | 1965 | 23232 | 2735 | Jan08/87 Calibrated using 'high span' technique. |
| Jan14/87 | Hi/span | 356 | 24056 | 2096 | 1499 | 22824 | 2731 |  |
| Jan16/87 | Hi/span | 356 | 25152 | 1150 | 823 | 22248 | 3727 |  |
| Jan19/87 | Hi/span | 356 | 22190 | 1669 | 1194 | 23400 | -2404 |  |
| Jan20/87 | Hi/span | 356 | 23478 | 1778 | 1272 | 24372 | -2166 |  |
| Jan26/87 | Hi/span | 356 |  |  |  | 21132 |  | Jan26/87 Point in comm. failure #1. |
| Feb13/87 | Hi/span | 356 | 20626 | 2956 | 2114 | 22932 | -4420 |  |
|  |  |  |  |  |  |  |  |  |
| Feb18/87 | 'Devco' | 356 | 23781 | 2479 | 1773 | 23500 | 2046 | Feb17/87 Instrument recalibrated by 'Devco' method. |
| Feb19/87 | 'Devco' | 356 | 21783 | 1816 | 1299 | 22032 | -1548 |  |
| Feb20/87 | 'Devco' | 356 | 21450 | 1887 | 1350 | 22788 | -2688 |  |
| Feb23/87 | 'Devco' | 356 | 18786 | 3111 | 2225 | 22572 | -6011 |  |
| Feb24/87 | 'Devco' | 356 | 17958 | 2327 | 1665 | 22344 | -6051 |  |
| Feb25/87 | 'Devco' | 356 | 18970 | 1626 | 1163 | 23220 | -5413 |  |
| Mar02/87 | 'Devco' | 356 | 19154 | 1801 | 1288 | 23436 | -5570 |  |
| Mar16/87 | 'Devco' | 356 | 18050 | 1506 | 1077 | 21078 | -4105 |  |
|  |  |  |  |  |  |  |  |  |
| Jan12/87 | 'Devco' | 357 | 24131 | 4502 | 3220 | 25050 | -4139 | Jan08/87 Calibrated using the 'Devco' method. |
| Jan14/87 | 'Devco' | 357 | 25003 | 4212 | 3013 | 29190 | -7200 |  |
| Jan16/87 | 'Devco' | 357 | 25439 | 2996 | 2143 | 29435 | -6139 |  |
| Jan19/87 | 'Devco' | 357 | 25429 | 4878 | 3489 | 29960 | -8020 |  |
| Jan20/87 | 'Devco' | 357 | 26703 | 4721 | 3377 | 30940 | -7614 |  |
| Jan26/87 | 'Devco' | 357 | 23519 | 3849 | 2753 | 26985 | -6219 |  |
|  |  |  |  |  |  |  |  |  |
| Feb18/87 | Hi/span | 357 | 26214 | 3680 | 2632 | 30168 | -6586 | Feb17/87 Calibrated using 'high span' method. |
| Feb19/87 | Hi/span | 357 | 25631 | 4677 | 3345 | 28525 | -6239 |  |
| Feb20/87 | Hi/span | 357 | 26130 | 4639 | 3318 | 28945 | -6133 |  |
| Feb23/87 | Hi/span | 357 | 24191 | 3260 | 2332 | 29050 | -7191 |  |
| Feb24/87 | Hi/span | 357 | 27994 | 3729 | 2667 | 32357 | -7030 |  |
| Feb25/87 | Hi/span | 357 | 24633 | 3771 | 2697 | 29450 | -7514 |  |
| Mar02/87 | Hi/span | 357 | 27260 | 4213 | 3014 | 30940 | -6694 |  |
| Mar16/87 | Hi/span | 357 | 26464 | 3399 | 2431 | 26425 | 2470 |  |

## TABLE10: Evaluation of Jtec vs. Trolex Airflow Monitor Performance

### PERFORMANCE SUMMARY

| Sensor Type | Total Insp. | Avail. | Average Conspec Reading Mean | Average Conspec Reading STD | Average Conspec Reading 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| JTEC | 9 | 89% | 27885 | 1722 | 1232 | 26072 | 2241 |
| TROLEX | 9 | 100% | 25808 | 1943 | 1390 | 26072 | -217 |

| Date | Av | Sensor Type | Conspec Reading Mean | Conspec Reading STD | Conspec Reading 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Mar30/87 | Y | JTEC | 22742 | 1080 | 773 | 20772 | 2743 | May06/87 Output very high |
| Apr06/87 | Y | JTEC | 27250 | 1626 | 1163 | 23580 | 4833 | when blocked. |
| May06/87 | N | JTEC | 26667 | 2477 | 1772 | 27072 | -2177 | May14/87 Landing door open |
| May12/87 | Y | JTEC | 29636 | 1482 | 1060 | 25380 | 5316 | thereby increasing the air |
| May14/87 | Y | JTEC | 29006 | 1304 | 933 | 26244 | 3695 | volume at the point. |
| May14/87 | Y | JTEC | 33866 | 2582 | 1847 | 36324 | -4305 | May14-15/87 Output did not |
| May15/87 | Y | JTEC | 27836 | 2172 | 1554 | 26244 | 3146 | drop to near zero when |
| May19/87 | Y | JTEC | 26846 | 1142 | 817 | 24084 | 3579 | blocked; was about 12000 |
| May19/87 | Y | JTEC | 27116 | 1632 | 1167 | 24948 | 3335 | CFM, should be 4000 CFM. |
| Mar30/87 | Y | TROLEX | 17401 | 905 | 647 | 20772 | -4018 | |
| Apr01/87 | Y | TROLEX | 23864 | 1947 | 1393 | 23580 | 1677 | |
| May06/87 | Y | TROLEX | 26590 | 2774 | 1984 | 27072 | -2466 | |
| May12/87 | Y | TROLEX | 25699 | 2007 | 1436 | 25380 | 1755 | |
| May14/87 | Y | TROLEX | 26906 | 1335 | 955 | 26244 | 1617 | |
| May14/87 | Y | TROLEX | 34136 | 2773 | 1984 | 36324 | -4172 | May14/87 Landing door open |
| May15/87 | Y | TROLEX | 26113 | 1998 | 1429 | 26244 | -1560 | thereby increasing the air |
| May19/87 | Y | TROLEX | 25036 | 1703 | 1218 | 24084 | 2170 | volume at the point. |
| May19/87 | Y | TROLEX | 26527 | 2045 | 1463 | 24948 | 3042 | |

## TABLE 11: Performance Of Sieger BA5—Prince Mine—7 East Top

POINT NO: N/A DESCRIPTOR: Prince Mine 7 E Top Airf. INSTRUMENT TYPE: Sieger BA5

### PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Transmitton Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 8 | 100% | 44568 | 1201 | 859 | 37493 | 7934 |

| Date | Av | Cond | Transmitton Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun08/87 | Y | 1 | 44949 | 2166 | 1549 | 37230 | 9268 | NOTE:- volume measurements were made |
| Jun08/87 | Y | 1 | 43107 | 1038 | 742 | 37212 | 6637 | using an annemometer extension handle. |
| Jun08/87 | Y | 1 | 43340 | 1027 | 735 | 35364 | 8711 | The ventilation staff presently make |
| Jun08/87 | Y | 1 | 43848 | 1157 | 828 | 37002 | 7674 | their measurements without extension |
| Jun09/87 | Y | 1 | 45542 | 1224 | 876 | 37968 | 8450 | handles. A hand held test was done |
| Jun09/87 | Y | 1 | 45500 | 1191 | 852 | 37716 | 8636 | on Jun 9/87 with the following |
| Jun09/87 | Y | 1 | 44695 | 867 | 620 | 36304 | 7011 | result: CFM = 46536; STD = 832. |
| Jun09/87 | Y | 1 | 45563 | 935 | 669 | 39144 | 7088 | |

## TABLE 12: Performance Of Sieger BA5—Prince Mine—East High Main

POINT NO: N/A DESCRIPTOR: Prince Mine East High Main Airf. INSTRUMENT TYPE: Sieger BA5

PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Transmitton Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 8 | 100% | 53335 | 1715 | 1227 | 42878 | 11683 |

| Date | Av | Cond | Transmitton Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun08/87 | Y | 1 | 53661 | 2955 | 2114 | 43056 | 12719 | NOTE:- volume measurements were made using an annemometer extension handle. The ventilation staff presently make their measurements without extension handles. A hand held test was done on Jun 9/87 with the following result: CFM = 54576; STD = 0. |
| Jun08/87 | Y | 1 | 51301 | 1881 | 1345 | 40600 | 12030 | |
| Jun08/87 | Y | 1 | 52212 | 1758 | 1257 | 42480 | 10989 | |
| Jun08/87 | Y | 1 | 51132 | 1769 | 1265 | 41220 | 11177 | |
| Jun09/87 | Y | 1 | 54562 | 1419 | 1015 | 43146 | 12431 | |
| Jun09/87 | Y | 1 | 54181 | 850 | 608 | 44208 | 10581 | |
| Jun09/87 | Y | 1 | 55260 | 1497 | 1071 | 43776 | 12555 | |
| Jun09/87 | Y | 1 | 54371 | 1590 | 1137 | 44532 | 10976 | |

## TABLE 13: Summary of System Problems

| Item | Problems Noted. | | No. Occur | Hours Downtime |
|---|---|---|---|---|
| Senturion 200 | Alarm buffer full - reboot needed. | | 5 | 2.5 |
| Senturion 200 | In Diagnostics mode for Canmet outstation. | | 1 | 1.5 |
| Senturion 200 | Disk Drive errors necessitated repairs. | | 1 | 5.5 |
| Senturion 200 | New software installed. | | 1 | 8.0 |
| Senturion 200 | Reboot - New disk-drive installed. | | 1 | 2.0 |
| Senturion 200 | Reboot - no apparent reason | | 16 | 9.9 |
| Senturion 200 | When "SVD" attempted, computer crashed. | | 1 | 0.5 |
| | | TOTAL : | 26 | 29.9 |
| Quay 910 | Rebooted - no apparent reason for crash | | 6 | 26.3 |
| Quay 910 | Unable to reboot | | 1 | 264.0 |
| Quay 910 | Removed for repairs | | 1 | 3000.0 |
| Quay 910 | Repeated tries needed for floppy disk | | 1 | 0.5 |
| | | TOTAL : | 9 | 3290.8 |
| UPS Bat.Backup | Failed during power failure. | | 2 | 1.3 |
| UPS Bat.Backup | Unable to operate Quay 910. | | 1 | 0.5 |
| UPS Bat.Backup | Bat. Backup unreliable. | | 1 | 8758.2 |
| | | TOTAL : | 4 | 8760.0 |
| Televideo CRT | Screen dim - Getting hard to read. | | 2 | 912.0 |
| | | TOTAL : | 2 | 912.0 |
| ISC Color CRT #1 | --- | | 0 | 0.0 |
| | | TOTAL : | 0 | 0.0 |
| ISC Color CRT #2 | --- | | 0 | 0.0 |
| | | TOTAL : | 0 | 0.0 |
| M.T. Pr. 1 | Blown fuse | | 1 | 0.5 |
| M.T. Pr. 1 | No apparent reason | | 1 | 3.5 |
| | | TOTAL : | 2 | 4.0 |
| M.T. Pr. 2 | Printed circuit board burned out. | | 1 | 120.0 |
| M.T. Pr. 2 | Removed for repairs | | 1 | 4296.0 |
| | | TOTAL : | 2 | 4416.0 |

## TABLE 13: Summary of System Problems (cont.)

| Item | Problems Noted. | No. Occur | Hours Downtime |
|---|---|---|---|
| ISC Color Pr. | Needs print head ink gasket. | 1 | 0.5 |
| ISC Color Pr. | Removed for repairs | 1 | 216.0 |
| | TOTAL : | 2 | 216.5 |
| Outstations | Canmet outstation has intermittent fuse on local trunk. | 1 | 168.0 |
| Outstations | Canmet's Bat. Backup failed. | 1 | 144.0 |
| Outstations | Canmet's Bat. backup unreliable. | 1 | 2232.0 |
| Outstations | Defective accessor card in Canmet outstation. | 1 | 1.5 |
| Outstations | Fuses blown in Canmet trunkline, lost outstation. | 2 | 242.0 |
| Outstations | Problem driving Canmet local trunk line. | 1 | 4248.0 |
| | TOTAL : | 7 | 7035.5 |

# Photographs

Photo 1: Lingan Colliery - Central Monitoring Station - Conspec System.

Photo 2: Lingan Colliery - Central Monitoring Station - Conspec System.

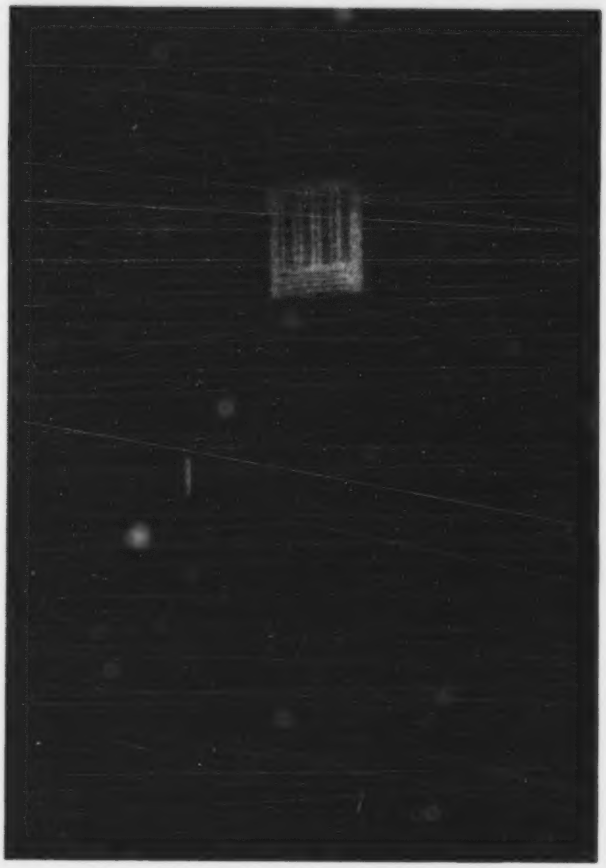


Photo 3: Lingan Colliery - Computer Rack - Conspec System.

Photo 4: Lingan Colliery - Control Terminal Screen - Conspec System.

Photo 5: Lingan Colliery - 10 East Wall Outstation - Conspec System.

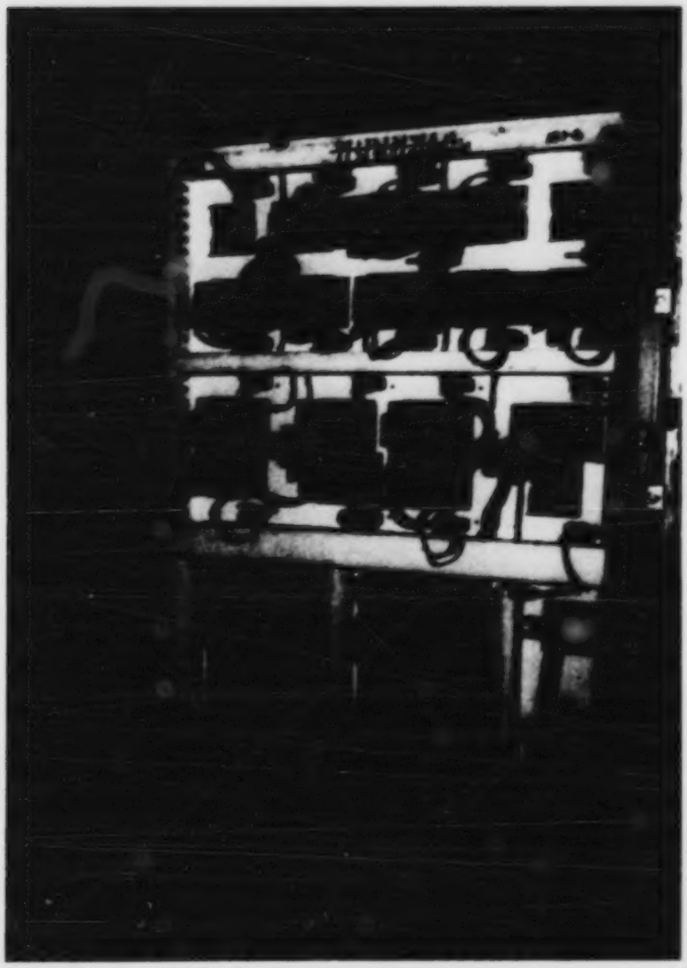


Photo 6: Lingan Colliery - Outstation Accessor Cards - Conspec System.

Photo 7: Lingan Colliery - checking BM1 detector head with D6 methanometer.

Photo 8: Lingan Colliery - BM2H Sample lines.

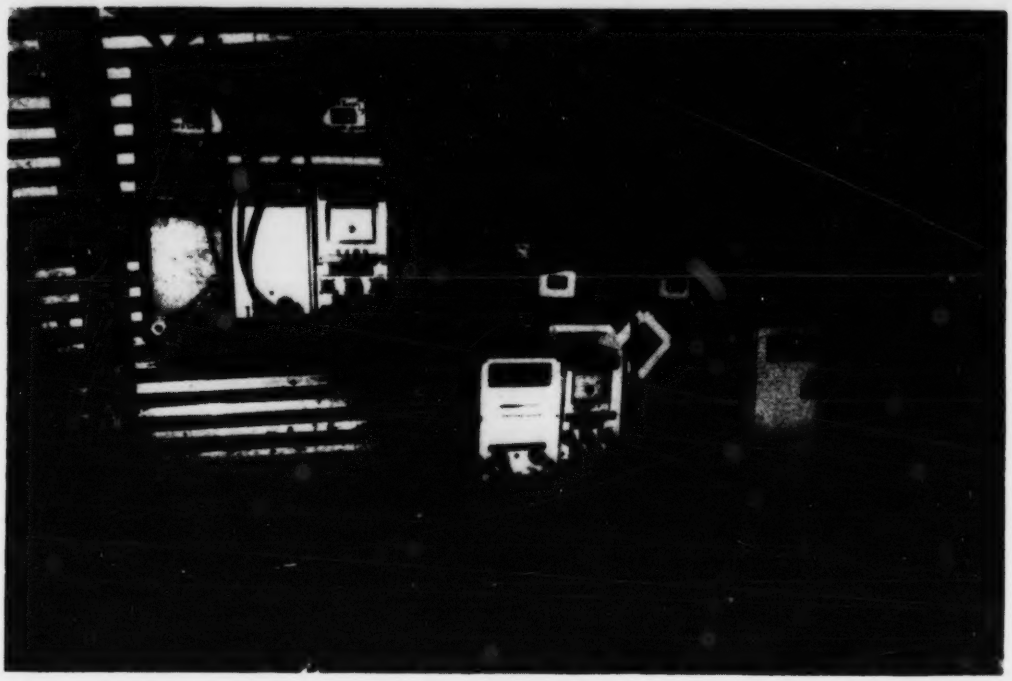


Photo 9: Lingan Colliery - BM1 and BM2H Control Units.

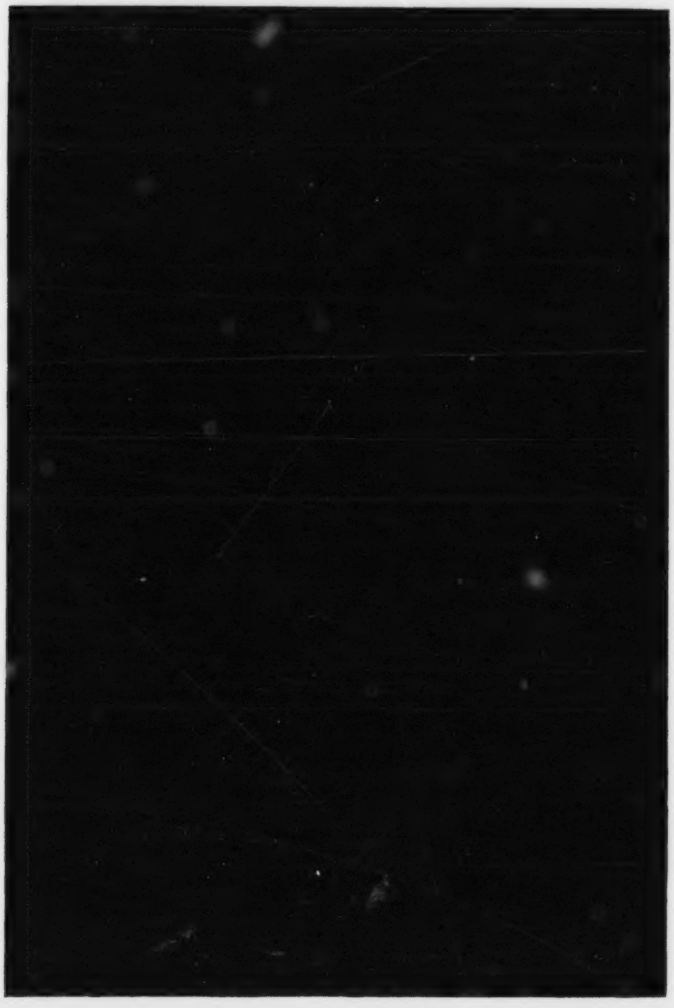


Photo 10: Lingan Colliery - checking J-Tec with hand-held anemometer.

Photo 11: Lingan Colliery - checking J-Tec with extension handle anemometer.

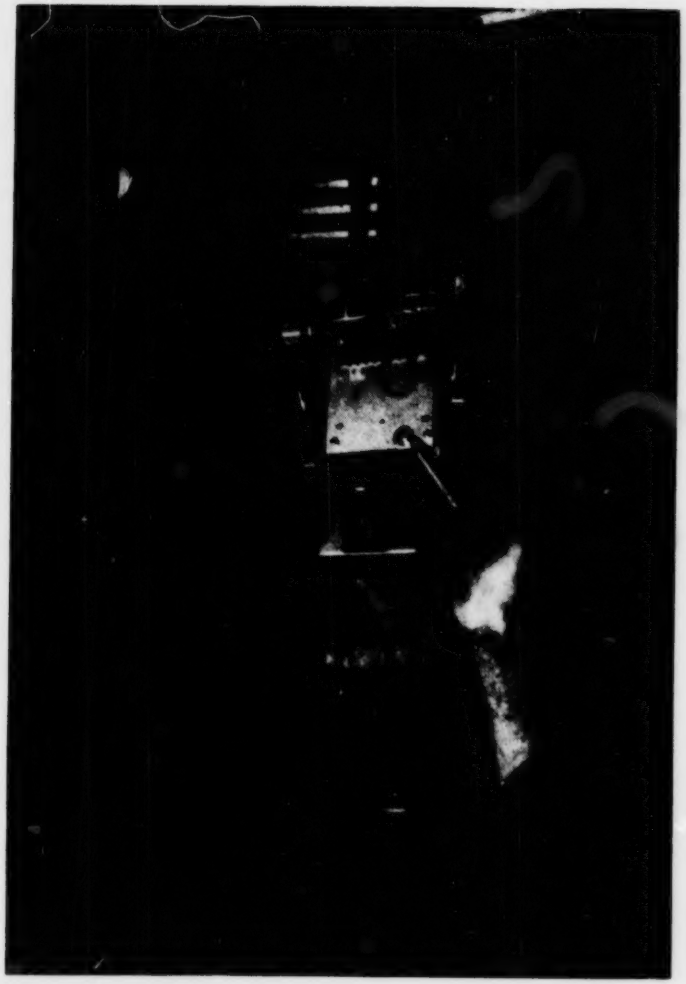


Photo 12: Lingan Colliery - J-Tec span control.

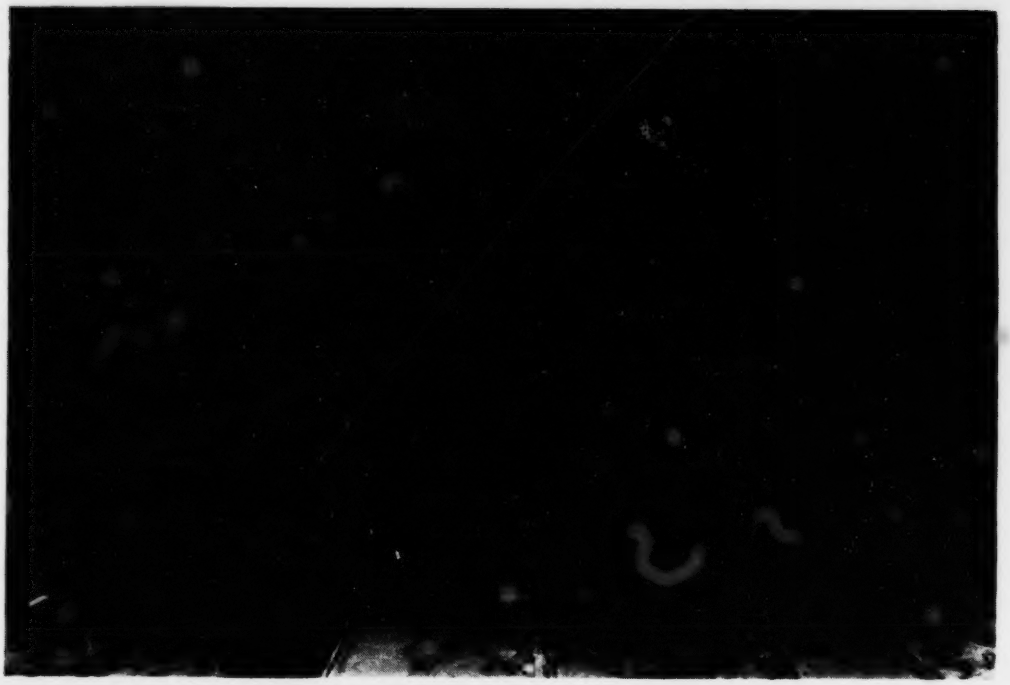


Photo 13: Lingan Colliery - Photographic method of area determination.

Photo 14: Lingan Colliery - J-Tec gas flow transducer.

Photo 15: Lingan Colliery Pumping station Outstation.

Photo 16: Lingan Colliery - Discharge water flow transducer.

Photo 17: Lingan Colliery - 2 Deep Door position indicator switches.

Photo 18: Lingan Colliery - 2 Hoist-Door indicator lights.

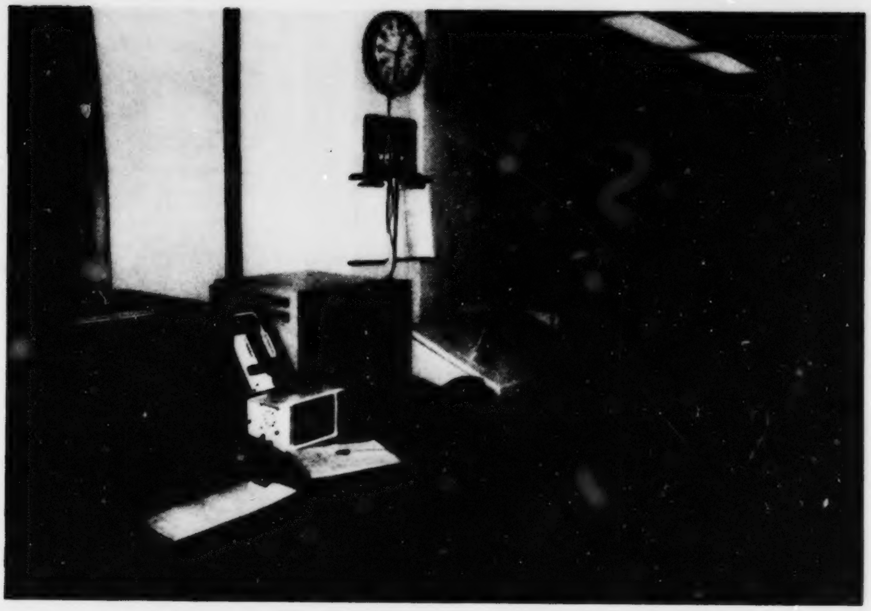


Photo 19: Prince Colliery - Central Monitoring Station - Transmitton System.

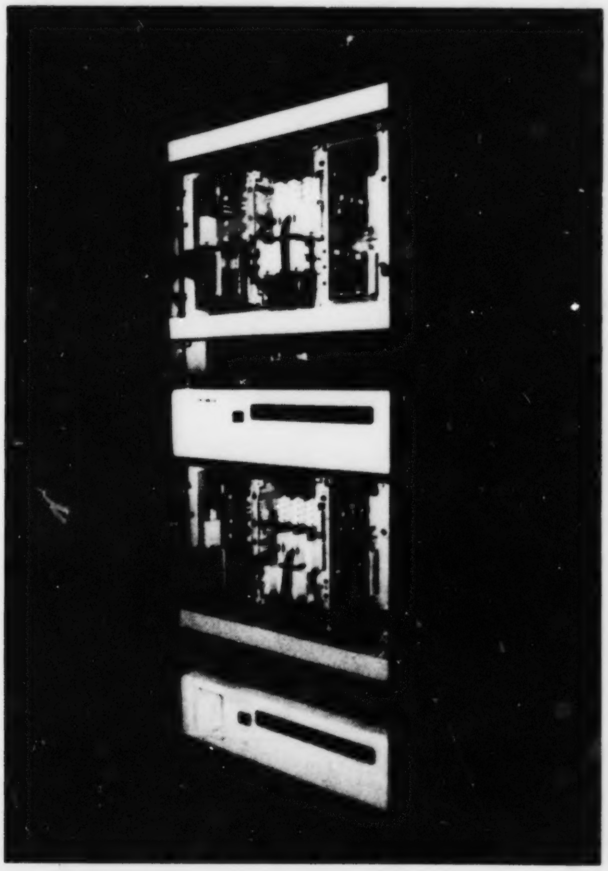


Photo 20: Prince Colliery - Computer Rack - Transmitton System.

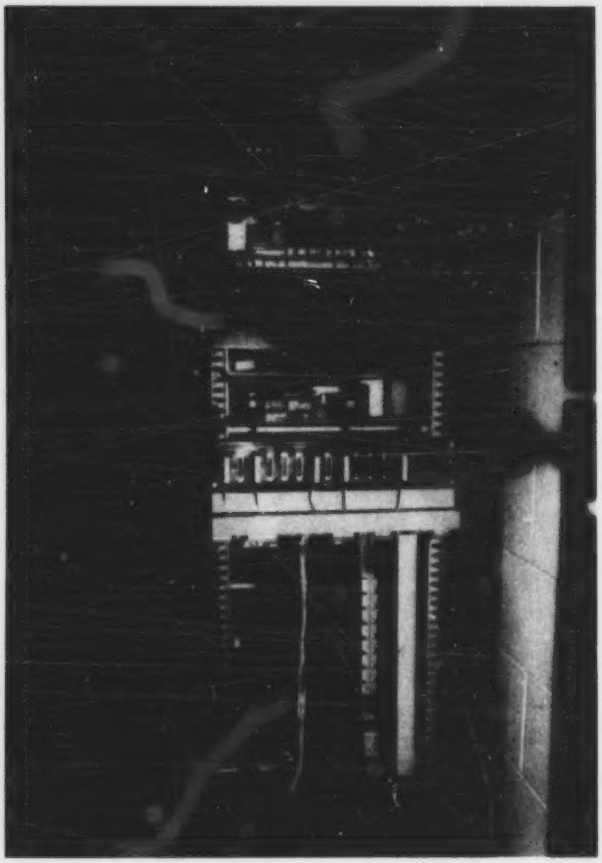


Photo 21: Prince Colliery - Computer Rack (Rear) - Transmitton System.

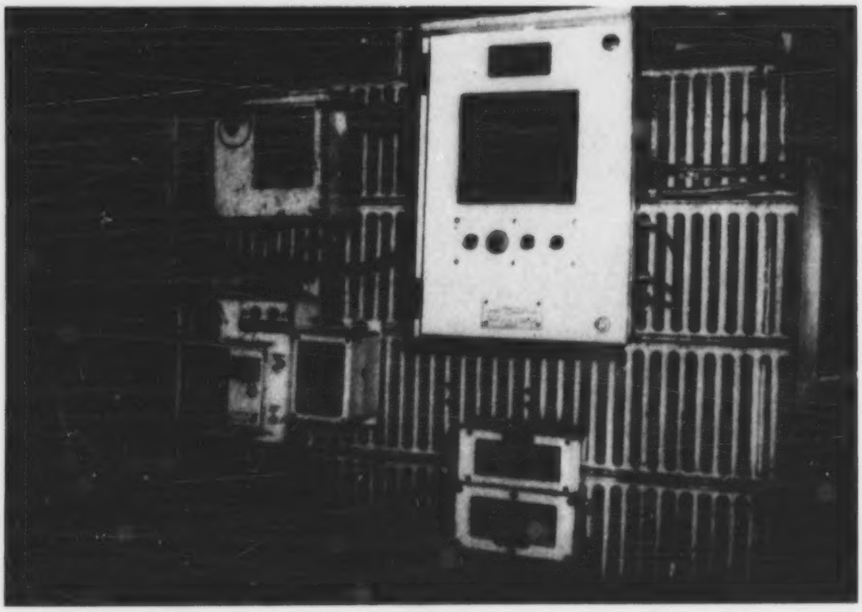


Photo 22: Prince Colliery - West Wall Outstation - Transmitton System.

Photo 23: Prince Colliery - Sieger BA5 and control units.

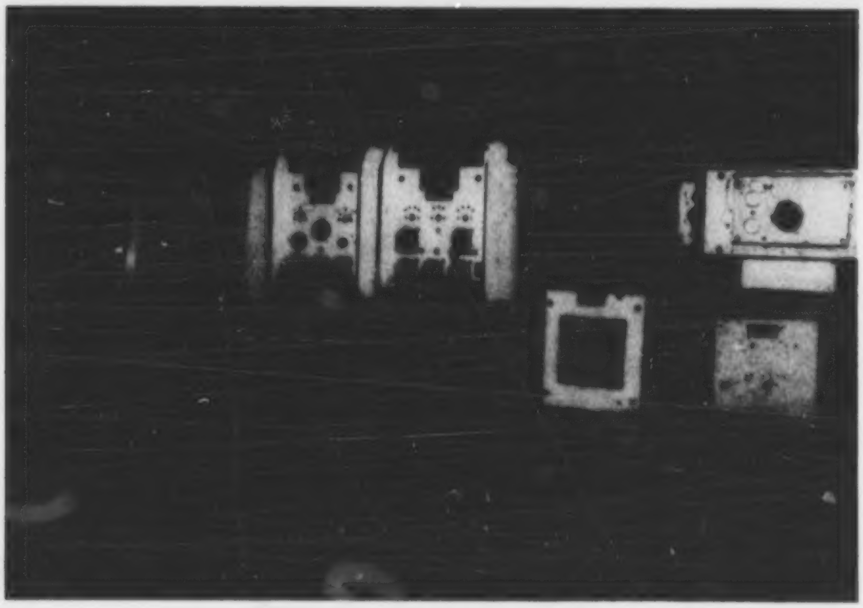


Photo: 24: Prince Colliery - BM1, C0 and Sieger BA5 control units.

# Appendix 1

## OVERALL PERFORMANCE OF JTEC AIRFLOW SENSORS
(Trend Log Data)

| | |
|---|---|
| Total Instruments | 15 |
| Total Inspections | 371 |
| Average Error (95% CL) (weighted) | 3378 |
| Availability | 89% |

## PERFORMANCE SUMMARY BY INSTRUMENT

| Point No. | Descriptor | Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | Average Conspec Reading STD | Average Conspec Reading 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|---|---|
| 015 | 10 E Top Level | 1 | 13 | 77% | 67475 | 5343 | 3822 | 58164 | 10685 |
| 016 | 10 E Coal Rd. | 1 | 10 | 100% | 49637 | 3089 | 2209 | 54288 | -4918 |
| 045 | 6 W Top Level | 1 | 28 | 93% | 93224 | 6469 | 4628 | 61296 | 34888 |
| 046 | 6 W Coal Rd. | 1 | 28 | 82% | 57050 | 4124 | 2950 | 64514 | -9596 |
| 075 | 9 E Top Level | 1 | 19 | 100% | 86013 | 6530 | 4671 | 83931 | 2950 |
| | | 2 | 4 | 100% | 46895 | 5118 | 3661 | 40854 | 10693 |
| | | 3 | 23 | 100% | 15541 | 6658 | 4762 | 19746 | -6644 |
| 076 | 9 E Coal Rd. | 1 | 16 | 100% | 92821 | 4281 | 3062 | 81489 | 14404 |
| | | 2 | 2 | 100% | 52289 | 4755 | 3401 | 41575 | 13230 |
| | | 3 | 19 | 58% | 70959 | 4736 | 3387 | 60571 | 13566 |
| 077 | 9 E Outside cundy | 3 | 3 | 100% | 20554 | 1698 | 1214 | 18931 | 1181 |
| 078 | 9 E Inside Cundy | 3 | 3 | 100% | 41675 | 1802 | 1289 | 46437 | -6051 |
| 103/218 | Main Fan: Xcut | 1 | 18 | 100% | 197358 | 5851 | 4185 | 190694 | 3041 |
| 104/219 | Main Fan: 1 Deep | 1 | 17 | 100% | 149477 | 7205 | 5154 | 143711 | 8227 |
| 356 | 9 E Study: Airflow 1 | 1 | 14 | 86% | 40773 | 2604 | 1863 | 45793 | 3098 |
| | | 2 | 3 | 100% | 33114 | 2731 | 1953 | 22984 | 11668 |
| | | 3 | 35 | 94% | 23098 | 2087 | 1493 | 23373 | -591 |
| 357 | 9 E Study: Airflow 2 | 1 | 15 | 60% | 47227 | 2923 | 2091 | 40736 | 6964 |
| | | 2 | 3 | 100% | 21492 | 1874 | 1340 | 21502 | 131 |
| | | 3 | 25 | 100% | 27313 | 3953 | 2827 | 30638 | -5443 |
| 358 | 9 E Study: Airflow 3 | 1 | 15 | 87% | 28364 | 1662 | 1189 | 34675 | -6409 |
| | | 2 | 3 | 100% | 16285 | 1343 | 961 | 16536 | -621 |
| | | 3 | 20 | 100% | 26316 | 1818 | 1300 | 27592 | -1995 |

PERFORMANCE SUMMARY BY INSTRUMENT (Continued)

| Point No. | Descriptor | Cond. | Total Insp. | Avail. | Average Conspec Reading |  |  | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Mean | STD | 95%CL |  |  |
| 361 | 9 E Study: Airflow 6 | 1 | 13 | 100% | 32047 | 800 | 578 | 33304 | -1678 |
|  |  | 3 | 19 | 53% | 36826 | 1547 | 1107 | 36199 | 243 |
| 366 | 9 E Study: Airflow 4 | 3 | 3 | 0% | 43610 | 3240 | 2318 | 32076 | N/A |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 15 DESCRIPTOR: 10 E Top Level Airflow INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 13 | 77% | 67475 | 5343 | 3822 | 58164 | 10685 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Nov18/86 | Y | 1 | 81653 | 3449 | 2467 | 54849 | 29271 | |
| Nov24/86 | Y | 1 | 79504 | 4109 | 2939 | 56612 | 25831 | |
| Dec01/86 | N | 1 | | | | 57387 | | Dec01/86 Commun. Failure. |
| Dec12/86 | N | 1 | | | | 54665 | | Dec04/86 New area determined: 145 |
| Dec16/86 | N | 1 | | | | 58580 | | SqFt. (was 141). |
| Jan28/87 | Y | 1 | 52464 | 6127 | 4383 | 59813 | -11732 | Dec12/86 Commun. Failure. |
| Feb10/87 | Y | 1 | 41629 | 5690 | 4070 | 59958 | -22399 | Dec16/86 Commun. Failure. |
| Feb20/87 | Y | 1 | 87222 | 14872 | 12637 | 61115 | 38744 | |
| Mar03/87 | Y | 1 | 58642 | 5987 | 4283 | 59955 | -5596 | Mar03/87 Found in comm. failure when |
| Mar09/87 | Y | 1 | 62656 | 3508 | 2509 | 59162 | 6003 | checked. |
| Mar12/87 | Y | 1 | 60853 | 2752 | 1969 | 54918 | 7904 | |
| Apr01/87 | Y | 1 | 62471 | 4344 | 3107 | 56405 | 9173 | |
| May22/87 | Y | 1 | 47680 | 2594 | 1955 | 62785 | -16962 | |

## DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 16 DESCRIPTOR: 10 E Coal Rd. Airflow INSTRUMENT TYPE: Jtec

### PERFORMANCE SUMMARY

|  |  |  | Average Conspec Reading |  |  | Av. | Max. |
|---|---|---|---|---|---|---|---|
| Cond. | Total Insp. | Avail. | Mean | STD | 95%CL | Testec Value | Error @ 95%CL |
| 1 | 10 | 100% | 49637 | 3089 | 2209 | 54288 | -4918 |

|  |  |  | Conspec Reading |  |  |  | Max. |  |
|---|---|---|---|---|---|---|---|---|
| Date | Av | Cond | Mean | STD | 95%CL | Tested Value | Error @ 95%CL | Comments |
| Dec01/86 | Y | 1 | 70359 | 3128 | 2237 | 53933 | 18663 | Dec04/86 New area determined 87 sqft (was 85). |
| Dec12/86 | Y | 1 | 38899 | 1760 | 1259 | 52785 | -15145 |  |
| Dec16/86 | Y | 1 | 37859 | 3628 | 2595 | 54145 | -18881 |  |
| Jan28/87 | Y | 1 | 37989 | 1598 | 1143 | 53890 | -17844 |  |
| Feb10/87 | Y | 1 | 41629 | 5690 | 4070 | 54485 | -16926 |  |
| Feb20/87 | Y | 1 | 43189 | 2656 | 1900 | 56228 | -14939 |  |
| Mar09/87 | Y | 1 | 42019 | 1981 | 1417 | 56143 | -15541 |  |
| Mar10/87 | Y | 1 | 65159 | 2571 | 1812 | 51999 | 14972 |  |
| Apr01/87 | Y | 1 | 61389 | 1711 | 1224 | 54188 | 8425 |  |
| May22/87 | Y | 1 | 57879 | 6203 | 4437 | 55082 | 7234 |  |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 45 DESCRIPTOR: 6W Top Level Airflow INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading | | | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| | | | Mean | STD | 95%CL | | |
| 1 | 28 | 93% | 93224 | 6469 | 4628 | 61296 | 34888 |

| Date | Av | Cond | Conspec Reading | | | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| | | | Mean | STD | 95%CL | | | |
| Jun 3/86 | Y | 1 | 98109 | 5121 | 3663 | 61400 | 40372 | |
| Jun17/86 | Y | 1 | 102460 | 1187 | 849 | 58823 | 44486 | |
| Jul14/86 | Y | 1 | 98900 | 8005 | 5726 | 58200 | 46426 | |
| Jul18/86 | Y | 1 | 97832 | 11170 | 7990 | 56414 | 49408 | |
| Jul28/86 | N | 1 | | | | 31200 | | Jul28/86 communic. fail. |
| Aug12/86 | Y | 1 | 101273 | 1453 | 1039 | 58058 | 44254 | |
| Aug18/86 | Y | 1 | 101392 | 2680 | 1917 | 57057 | 46252 | |
| Aug28/86 | Y | 1 | 101443 | 2018 | 1443 | 59774 | 43112 | |
| Sep10/86 | Y | 1 | 102460 | 1453 | 1039 | 59703 | 43796 | |
| Sep16/86 | Y | 1 | 101214 | 2228 | 1594 | 61633 | 41175 | |
| Sep19/86 | Y | 1 | 100480 | 3140 | 2246 | 57844 | 44882 | |
| Sep23/86 | Y | 1 | 103528 | 919 | 657 | 67425 | 36760 | |
| Oct01/86 | Y | 1 | 101392 | 4128 | 2953 | 70428 | 33917 | |
| Oct09/86 | Y | 1 | 102994 | 1465 | 1048 | 67067 | 36975 | |
| Oct15/86 | Y | 1 | 102394 | 2519 | 1802 | 66781 | 37415 | Oct21/86 Span adjusted from maximum to |
| Oct27/86 | N | 1 | 104062 | 1313 | 939 | 68068 | 36933 | minimum- no response on surface. |
| Nov25/86 | Y | 1 | 103884 | 751 | 537 | 69427 | 34994 | Oct27/86 Point shows no response to |
| Dec01/86 | Y | 1 | 104774 | 2064 | 1476 | 68068 | 38182 | blocking. |
| Dec15/86 | Y | 1 | 78060 | 15149 | 10836 | 64416 | 24480 | Dec 4/86 new area=132 (was 143)sqft. |
| Dec16/86 | Y | 1 | 79004 | 1432 | 1024 | 62700 | 17328 | new corr. fac. and offset entered |
| Jan20/87 | Y | 1 | 68560 | 21660 | 15499 | 58806 | 25253 | |
| Feb03/87 | Y | 1 | 82060 | 17320 | 12389 | 62898 | 31551 | |
| Feb10/87 | Y | 1 | 92373 | 10357 | 7408 | 63624 | 36157 | |
| Mar09/87 | Y | 1 | 93310 | 4009 | 2868 | 64416 | 31762 | |
| Mar12/87 | Y | 1 | 89710 | 7157 | 5119 | 64251 | 30578 | |
| Mar17/87 | Y | 1 | 87160 | 9439 | 6752 | 64416 | 29496 | |
| Apr01/87 | Y | 1 | 53560 | 10440 | 7468 | 54700 | -8600 | |
| May19/87 | Y | 1 | 64660 | 26000 | 18661 | 58600 | 24713 | May19/87 Output very erratic- high STD. |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 46 DESCRIPTOR: 6W Coal Rd. Airflow INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 28 | 82% | 57050 | 4124 | 2950 | 64514 | -9596 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun03/86 | Y | 1 | 82702 | 4063 | 2906 | 60227 | 25381 | |
| Jun17/86 | Y | 1 | 56536 | 1838 | 1315 | 61133 | -5912 | |
| Jul14/86 | Y | 1 | 51374 | 2381 | 1703 | 56963 | -7292 | |
| Jul18/86 | Y | 1 | 51374 | 10106 | 7229 | 55664 | -11519 | |
| Jul28/86 | Y | 1 | 51018 | 2961 | 2118 | 31304 | 21832 | |
| Aug18/86 | Y | 1 | 51284 | 3583 | 2563 | 60032 | -11311 | |
| Aug28/86 | Y | 1 | 68640 | 2907 | 2079 | 62272 | 8447 | |
| Sep10/86 | Y | 1 | 56971 | 2373 | 1697 | 63280 | -8006 | |
| Sep16/86 | Y | 1 | 52818 | 3663 | 2620 | 62216 | -12018 | |
| Sep19/86 | Y | 1 | 64902 | 2508 | 1794 | 64120 | 2576 | |
| Sep23/86 | Y | 1 | 57960 | 2907 | 2079 | 76328 | -20447 | |
| Oct01/86 | N | 1 | 62588 | 8144 | 5825 | 77392 | -20629 | Oct01/86 Provides output but does |
| Oct07/86 | N | 1 | 61520 | 3140 | 2246 | 66927 | -7653 | not respond to blocking. |
| Oct09/86 | N | 1 | 60452 | 6234 | 4459 | 71008 | -15015 | |
| Oct15/86 | N | 1 | 63478 | 2131 | 1524 | 75600 | -13646 | |
| Nov18/86 | N | 1 | | | | 62403 | | Nov18/86 Provides output but still |
| Dec01/86 | Y | 1 | 59740 | 2373 | 1697 | 72976 | -14933 | does not respond to blocking. |
| Dec15/86 | Y | 1 | 38893 | 3162 | 2262 | 69113 | -32482 | Dec01/86 Output increases 20,000 CFM |
| Dec16/86 | Y | 1 | 41110 | 3004 | 2149 | 69577 | -30616 | when blocked. |
| Jan20/87 | Y | 1 | 42010 | 2242 | 1604 | 63600 | -23194 | Dec04/86 New area determined 103 |
| Jan28/87 | Y | 1 | 51910 | 4714 | 3372 | 66641 | -18103 | SqFt. (was 109). |
| Feb03/87 | Y | 1 | 56660 | 4351 | 3112 | 66744 | -13196 | Dec16/86 Output increases by 30,000 |
| Feb10/87 | Y | 1 | 59560 | 8093 | 5789 | 64066 | -10295 | CFM when blocked. |
| Mar03/87 | Y | 1 | 53560 | 4583 | 3278 | 68907 | -18625 | Jan20/87 Output increases by 20,000 |
| Mar12/87 | Y | 1 | 54460 | 6716 | 4804 | 67748 | -18092 | CFM when blocked. |
| Mar17/87 | Y | 1 | 61060 | 3464 | 2478 | 65766 | -7184 | Feb10/87 Output increases when |
| Apr01/87 | Y | 1 | 54160 | 5254 | 3758 | 62985 | -12583 | blocked. |
| May19/87 | Y | 1 | 73623 | 4460 | 3190 | 61308 | 15425 | Mar03/87 Output increases when |
| | | | | | | | | blocked. |
| | | | | | | | | Mar17/87 Output drops only 20,000 |
| | | | | | | | | CFM when blocked. |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 75    DESCRIPTOR: 9E Top Level Airflow    INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 19 | 100% | 86013 | 6530 | 4671 | 83931 | 2950 |
| 2 | 4 | 100% | 46895 | 5118 | 3661 | 40854 | 10693 |
| 3 | 23 | 100% | 15541 | 6658 | 4762 | 19746 | -6644 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun04/86 | Y | 1 | 83664 | 4809 | 3440 | 84100 | -3876 | |
| Jun06/86 | Y | 1 | 88500 | 5770 | 4127 | 85480 | 7147 | |
| Jun12/86 | Y | 1 | 83242 | 7367 | 5270 | 65079 | -7109 | |
| Jun16/86 | Y | 1 | 82797 | 5827 | 4168 | 84303 | -5684 | |
| Jun18/86 | Y | 1 | 84859 | 4217 | 3016 | 86746 | -4573 | |
| Jun27/86 | Y | 1 | 85744 | 7006 | 5011 | 87002 | -6267 | |
| Jul15/86 | Y | 1 | 76384 | 5784 | 4137 | 79527 | -7260 | |
| Aug06/86 | Y | 1 | 87200 | | | 79750 | | Aug06/86 Main fan back on. |
| Aug11/86 | Y | 1 | 80960 | | | 78880 | | |
| Aug15/86 | Y | 1 | 97006 | 8719 | 6237 | 82215 | 21028 | |
| Aug19/86 | Y | 1 | 90840 | 8737 | 6250 | 85260 | 11830 | |
| Aug21/86 | Y | 1 | 84912 | 7101 | 5079 | 83863 | 6108 | |
| Aug25/86 | Y | 1 | 88656 | 6937 | 4962 | 83375 | 12243 | Aug25/86 Measurement with a ten- |
| Aug27/86 | Y | 1 | 87616 | 8252 | 5901 | 85550 | 7967 | sion handle: 0=62393 cfm |
| [illegible] | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| Sep02/86 | Y | 1 | 82624 | 6415 | 4589 | 85260 | -7225 | |
| Sep04/86 | Y | 1 | 90528 | 6878 | 4920 | 84173 | 11275 | |
| Sep09/86 | Y | 1 | 88032 | 4723 | 3378 | 85478 | 5932 | |
| Sep17/86 | Y | 1 | 82208 | 4922 | 3521 | 81708 | 4021 | |
| Jul21/86 | Y | 2 | 43500 | | | 40093 | | Main fan off for vacation period |
| Jul24/86 | Y | 2 | 43520 | | | 40091 | | " " " |
| Jul30/86 | Y | 2 | 48720 | 5118 | 3661 | 41688 | 10693 | " " " |
| Jul31/86 | Y | 2 | 51840 | | | 41543 | | " " " |
| Sep22/86 | Y | 3 | 17520 | 6881 | 4922 | 21720 | -9122 | Wall switched to cundy ventilation |
| Sep25/86 | Y | 3 | 15856 | 7535 | 5390 | 19800 | -9334 | |
| Sep30/86 | Y | 3 | 14192 | 5321 | 3806 | 20140 | -9754 | |
| Oct02/86 | Y | 3 | 19253 | 8825 | 6313 | 22360 | -9420 | |
| Oct06/86 | Y | 3 | 26256 | 18554 | 13272 | 22240 | 17288 | |
| Oct08/86 | Y | 3 | 10656 | 4883 | 3493 | 21520 | -14357 | Oct08/86 Jtec blocked with no |
| Oct15/86 | Y | 3 | 17936 | 8265 | 5912 | 18920 | -6896 | apparent response. |
| Oct23/86 | Y | 3 | 14606 | 6463 | 4623 | 18880 | -8895 | |

Point No. 075 Continued:

| Date | Av | Cond | Conspec Reading<br>Mean | <br>STD | <br>95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Nov14/86 | Y | 3 | 19484 | 6074 | 4345 | 15880 | 7949 | |
| Nov17/86 | Y | 3 | 12944 | 7406 | 5298 | 18920 | -11274 | |
| Nov25/86 | Y | 3 | 24107 | 4878 | 3489 | 19120 | 8476 | |
| Dec02/86 | Y | 3 | 13568 | 7219 | 5164 | 19440 | -11036 | |
| Dec15/86 | Y | 3 | 10864 | 6654 | 4760 | 18240 | -12136 | |
| Dec16/86 | Y | 3 | 13360 | 5738 | 4104 | 18760 | -9504 | |
| Dec23/86 | Y | 3 | 14816 | 6707 | 4798 | 18880 | -8862 | |
| Jan19/87 | Y | 3 | 21680 | 7860 | 5622 | 19360 | 7942 | |
| Feb06/87 | Y | 3 | 16711 | 9033 | 6461 | 17200 | -6950 | |
| Feb18/87 | Y | 3 | 9616 | 2782 | 1990 | 19760 | -12134 | |
| Mar02/87 | Y | 3 | 17728 | 7351 | 5258 | 22640 | -10170 | |
| Mar12/87 | Y | 3 | 15232 | 6947 | 4969 | 18580 | -8317 | |
| Apr01/87 | Y | 3 | 14383 | 4110 | 2940 | 20920 | -9477 | |
| May06/87 | Y | 3 | 9547 | 2548 | 1823 | 25040 | -17316 | |
| Jun03/87 | Y | 3 | 7120 | 1096 | 784 | 15640 | -9504 | |

# DAILY INSPECTION OF AIRFLOW SENSORS

**POINT NO:** 76 **DESCRIPTOR:** 9E Coal Rd. Airflow **INSTRUMENT TYPE:** Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 16 | 100% | 92821 | 4281 | 3062 | 81489 | 14404 |
| 2 | 2 | 100% | 52289 | 4755 | 3401 | 41575 | 13230 |
| 3 | 19 | 58% | 70959 | 4736 | 3387 | 60571 | 13566 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun04/86 | Y | 1 | 90971 | 2262 | 1618 | 88749 | 3840 | |
| Jun06/86 | Y | 1 | 91289 | 5405 | 3866 | 80750 | 14405 | |
| Jun12/86 | Y | 1 | 93239 | 5585 | 3995 | 85079 | 12155 | |
| Jun16/86 | Y | 1 | 92979 | 4131 | 2955 | 84966 | 10968 | |
| Jun18/86 | Y | 1 | 88539 | 4862 | 3478 | 80575 | 11442 | |
| Jul07/86 | Y | 1 | 95969 | 2467 | 1765 | 81500 | 16234 | |
| Jul15/86 | Y | 1 | 95579 | 6529 | 4670 | 81200 | 19049 | |
| Aug11/86 | Y | 1 | 92849 | | | 81650 | | Aug06/86 Main fan back on. |
| Aug15/86 | Y | 1 | 97014 | 6035 | 4317 | 78400 | 22931 | |
| Aug19/86 | Y | 1 | 95059 | 3127 | 2237 | 78850 | 18446 | |
| Aug21/86 | Y | 1 | 87259 | 3780 | 2704 | 76750 | 13213 | |
| Aug25/86 | Y | 1 | 94019 | 5393 | 3858 | 79400 | 18477 | |
| Aug27/86 | Y | 1 | 91029 | 4715 | 3373 | 77950 | 16452 | |
| Sep02/86 | Y | 1 | 94149 | 2874 | 2056 | 83650 | 12555 | |
| Sep04/86 | Y | 1 | 93174 | 3979 | 2845 | 81500 | 14519 | |
| Sep09/86 | Y | 1 | 92024 | 2797 | 2001 | 83250 | 10775 | |
| | | | | | | | | |
| Jul30/86 | Y | 2 | 50729 | 4755 | 3401 | 40900 | 13230 | Main fan off for vacation. |
| Jul31/86 | Y | 2 | 53849 | | | 42250 | | " " " |
| | | | | | | | | |
| Sep30/86 | Y | 3 | 85309 | 6214 | 4445 | 67500 | 22254 | Sep20/86 Wall switched to cundy ventilation. |
| Oct02/86 | Y | 3 | 86049 | 4009 | 2868 | 71100 | 17817 | |
| Oct06/86 | Y | 3 | 78939 | 5652 | 4043 | 63050 | 19932 | |
| Oct08/86 | Y | 3 | 82969 | 5852 | 4186 | 61700 | 25455 | |
| Oct20/86 | Y | 3 | 79719 | 3993 | 2856 | 63800 | 18775 | |
| Nov17/86 | Y | 3 | 81279 | 8368 | 5986 | 59000 | 28265 | Dec04/86 New area 99 sqft (was 100). |
| Dec02/86 | Y | 3 | 76079 | 6999 | 5006 | 51368 | 29717 | Dec05/86 Span adjusted by R.Pastuk. |
| Dec12/86 | Y | 3 | 65116 | 4596 | 3288 | 56876 | 11528 | |
| Dec15/86 | Y | 3 | 64119 | 1884 | 1348 | 61628 | 3839 | |
| Dec23/86 | Y | 3 | 60089 | 4453 | 3185 | 59846 | 3428 | |
| Feb06/87 | Y | 3 | 61909 | 3052 | 2183 | 48758 | 15334 | |
| Mar03/87 | N | 3 | 29929 | 1754 | 1255 | 62222 | -33548 | Mar03/87 Jtec does not respond to blocking, also output down to 30,000 |
| Mar12/87 | N | 3 | | | 0 | | 0 | |

Point No. 076 Continued:

| | | | Conspec Reading | | | Tested | Max. Error | |
|---|---|---|---|---|---|---|---|---|
| Date | Av | Cond | Mean | STD | 95%CL | Value | @ 95%CL | Comments |
| Mar17/87 | N | 3 | | | 0 | | 0 | CFM. Instrument removed. |
| Apr01/87 | N | 3 | | | 0 | | 0 | Mar12/87 Instrument still removed. |
| Apr06/87 | N | 3 | | | 0 | | 0 | Mar17/87 Instrument still removed. |
| Apr22/87 | N | 3 | | | 0 | | 0 | Apr01/87 Instrument still removed. |
| May06/87 | N | 3 | | | 0 | | 0 | Apr06/87 Instrument still removed. |
| Jun03/87 | N | 3 | | | 0 | | 0 | Apr22/87 Instrument still removed. |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 77 DESCRIPTOR: 9 E Outside C. Airflow INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| | | | Average Conspec Reading | | | Av. | Max. |
|---|---|---|---|---|---|---|---|
| Cond. | Total Insp. | Avail. | Mean | STD | 95%CL | Tested Value | Error @ 95%CL |
| 3 | 3 | 100% | 20554 | 1698 | 1214 | 18931 | 1181 |

| | | | Conspec Reading | | | | Max. | |
|---|---|---|---|---|---|---|---|---|
| Date | Av | Cond | Mean | STD | 95%CL | Tested Value | Error @ 95%CL | Comments |
| Mar30/87 | Y | 3 | 18338 | 2541 | 1816 | 18612 | -2092 | |
| Apr06/87 | Y | 3 | 18584 | 1619 | 1158 | 12564 | 7158 | Apr01/97 Inst. moved 150 ft. out |
| Jun02/87 | Y | 3 | 24740 | 933 | 667 | 25596 | -1523 | level. |

```
                        DAILY INSPECTION OF AIRFLOW SENSORS
                        ===================================

POINT NO:  78            DESCRIPTOR:   9 E Inside C. Airflow          INSTRUMENT TYPE:     Jtec
===================================================================================================

                                    PERFORMANCE SUMMARY
             ************************************************************************
             *                                 Average Conspec Reading      Av.    Max.    *
             *          Total                  ===========================  Tested  Error  *
             * Cond.    Insp.    Avail.    Mean       STD        95%CL      Value   @ 95%CL *
             *=====================================================================       *
             *   3        3       100%    41675      1802       1289       46437   -6051   *
             ************************************************************************

===================================================================================================
                                 Conspec Reading                      Max.
                          ===========================      Tested     Error
   Date      Av   Cond     Mean       STD      95%CL       Value    @ 95%CL Comments
===================================================================================================
 Mar30/87    Y     3      40621      1600      1144        42624     -3147
 Apr01/87    Y     3      41412      1755      1255        44568     -4411
 Jun02/87    Y     3      42992      2051      1467        52120    -10595
```

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 103/218 DESCRIPTOR: Main Fan: Xcut Airflow INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 18 | 100% | 197358 | 5851 | 4185 | 190694 | 3041 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun13/86 | Y | 1 | 251440 | | | 190800 | | |
| Aug15/86 | Y | 1 | 199276 | 5738 | 4104 | 198528 | 4852 | |
| Aug22/86 | Y | 1 | 197896 | 5072 | 3628 | 186912 | 14612 | |
| Sep18/86 | Y | 1 | 193480 | 8532 | 6103 | 199296 | -11919 | |
| Sep26/86 | Y | 1 | 194032 | 6736 | 4818 | 194016 | 4834 | |
| Oct03/86 | Y | 1 | 197620 | 5998 | 4290 | 191520 | 10390 | |
| Oct10/86 | Y | 1 | 191027 | 4010 | 2868 | 191616 | -3457 | |
| Nov05/86 | Y | 1 | 194860 | 5708 | 4083 | 193824 | 5119 | |
| Dec04/86 | Y | 1 | 187341 | 4736 | 3388 | 189600 | -5647 | |
| Dec18/86 | Y | 1 | 199828 | 7366 | 5269 | 194112 | 10985 | |
| Jan07/87 | Y | 1 | 180784 | 6130 | 4385 | 183552 | -7153 | |
| Jan30/87 | Y | 1 | 182440 | 4691 | 3355 | 189952 | -10867 | |
| Feb08/87 | Y | 1 | 175885 | 6420 | 4592 | 184416 | -13123 | |
| Feb27/87 | Y | 1 | 182992 | 2536 | 1814 | 188640 | -7462 | |
| Mar06/87 | Y | 1 | 203968 | 4659 | 3333 | | | Mar06/87 Airflow not tested. |
| Mar13/87 | Y | 1 | 203600 | 5345 | 3823 | 191568 | 15855 | |
| Mar20/87 | Y | 1 | 185507 | 6390 | 4571 | 186336 | -5400 | |
| May29/87 | Y | 1 | 230465 | 9400 | 6724 | 187104 | 50085 | May29/87 New point no.: 218 (was 103). |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 104/219 DESCRIPTOR: Main Fan: 1 Deep Airflow INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading<br>Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 17 | 100% | 149477 | 7205 | 5154 | 143711 | 8227 |

| Date | Av | Cond | Conspec Reading<br>Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun13/86 | Y | 1 | 141040 | | | 140840 | | |
| Aug15/86 | Y | 1 | 140764 | 4206 | 3009 | 145440 | -7685 | |
| Aug22/86 | Y | 1 | 140212 | 11057 | 8481 | 145344 | -13613 | |
| Sep18/86 | Y | 1 | 141868 | 5826 | 4167 | 149760 | -12059 | |
| Sep26/86 | Y | 1 | 143800 | 4868 | 3482 | 147840 | -7522 | |
| Oct03/86 | Y | 1 | 144628 | 4700 | 3362 | 143712 | 4278 | |
| Oct10/86 | Y | 1 | 155944 | 5848 | 4183 | 140160 | 19967 | |
| Nov05/86 | Y | 1 | 158213 | 7530 | 5386 | 139392 | 24227 | |
| Dec04/86 | Y | 1 | 152928 | 4877 | 3489 | 141696 | 14721 | |
| Dec18/86 | Y | 1 | 161182 | 7227 | 5012 | 144384 | 21826 | |
| Jan07/87 | Y | 1 | 148498 | 10249 | 7331 | 143328 | 12501 | |
| Jan30/87 | Y | 1 | 148760 | 8610 | 6159 | 142784 | 12135 | |
| Feb08/87 | Y | 1 | 151252 | 6890 | 4928 | 144576 | 11604 | |
| Feb27/87 | Y | 1 | 156772 | 9827 | 7029 | 141216 | 22585 | |
| Mar06/87 | Y | 1 | 157030 | 7070 | 5057 | | | Mar06/87 Airflow not tested. |
| Mar13/87 | Y | 1 | 149744 | 7787 | 5570 | 143136 | 12178 | |
| Mar20/87 | Y | 1 | 148492 | 8130 | 5815 | 137760 | 16547 | May29/87 New point no.: 219<br>was 104 |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 356 DESCRIPTOR: 9E Study: Airflow 1 INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 14 | 86% | 48773 | 2604 | 1863 | 45793 | 3098 |
| 2 | 3 | 100% | 33114 | 2731 | 1953 | 22984 | 11668 |
| 3 | 35 | 94% | 23098 | 2087 | 1493 | 23373 | -591 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jul07/86 | Y | 1 | 63907 | 3886 | 2780 | 45084 | 21603 | |
| Jul15/86 | Y | 1 | 60912 | 2321 | 1660 | 42772 | 19800 | Jul24/86 communication with all of |
| Aug06/86 | Y | 1 | 63215 | 1921 | 1374 | 55930 | 8659 | trunk 2 lost at 10:08 AM. |
| Aug11/86 | N | 1 | | | | 43860 | | Jul30/86 Trunk 2 still out. |
| Aug15/86 | Y | 1 | 44222 | 1939 | 1387 | 43792 | 1817 | Jul31/86 Trunk 2 returned to service. |
| Aug19/86 | Y | 1 | 44730 | 1394 | 997 | 43500 | 2227 | Aug06/86 Main fan back on, air was |
| Aug21/86 | Y | 1 | 45000 | 2846 | 2036 | 43894 | 3142 | tested without extension handle. |
| Aug25/86 | N | 1 | 46208 | 3103 | 2220 | 43656 | 4772 | Aug11/86 Commun.failure. |
| Aug27/86 | Y | 1 | 45184 | 4558 | 3260 | 47974 | -6050 | Aug21/86 Jtec blocked with no |
| Aug29/86 | Y | 1 | 44880 | 2176 | 1556 | 46580 | -3256 | response on surface. |
| Sep04/86 | Y | 1 | 45952 | 2041 | 1460 | 50388 | -5896 | Aug25/86 Span set to minimum. |
| Sep05/86 | Y | 1 | 44548 | 1936 | 1385 | 43723 | 2210 | Sep05/86 Point calibrated. |
| Sep09/86 | Y | 1 | 43171 | 4023 | 2878 | 45663 | -5370 | |
| Sep17/86 | Y | 1 | 42124 | 1706 | 1220 | 44265 | -3361 | |
| Jul21/86 | Y | 2 | 32205 | 3238 | 2316 | 22134 | 12387 | Jul21/86 Main fan off for vacation |
| Jul24/86 | Y | 2 | 33096 | | | 22134 | | period. |
| Jul31/86 | Y | 2 | 34042 | 2223 | 1590 | 24684 | 10948 | |
| Sep25/86 | Y | 3 | 21592 | 1835 | 1313 | 22783 | -2504 | Sep25/86 Wall switched to cundy |
| Sep30/86 | Y | 3 | 21578 | 1999 | 1430 | 20020 | 2988 | ventilation; Jtec turned around |
| Oct02/86 | Y | 3 | 23346 | 1499 | 1072 | 23075 | 1343 | because airflow is reversed. |
| Oct06/86 | Y | 3 | 25193 | 5185 | 3709 | 21710 | 7192 | |
| Oct08/86 | Y | 3 | 21834 | 1964 | 1405 | 21710 | 1529 | |
| Oct23/86 | Y | 3 | 20331 | 2467 | 1765 | 20703 | -2137 | |
| Nov14/86 | Y | 3 | 20154 | 1780 | 1273 | 21255 | -2374 | |
| Nov17/86 | Y | 3 | 19927 | 1616 | 1156 | 21938 | -3167 | |
| Nov24/86 | Y | 3 | 22364 | 1816 | 1299 | 22393 | -1328 | |
| Dec02/86 | Y | 3 | 18126 | 3215 | 2300 | 22165 | -6339 | Dec02/86 Span set to maximum; new |
| Dec23/86 | Y | 3 | 20469 | 3152 | 2255 | 24552 | -6338 | calibration procedure. |
| Jan12/87 | Y | 3 | 24002 | 2747 | 1965 | 23232 | 2735 | Dec04/86 New area 72 sqft (was 65). |
| Jan14/87 | Y | 3 | 24056 | 2096 | 1499 | 22824 | 2731 | Dec23/86 Resistors installed in |
| Jan16/87 | Y | 3 | 25152 | 1150 | 823 | 22248 | 3727 | trunk 2. |

Point No. 356 Continued:

|  |  |  | Conspec Reading |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|
| Date | Av | Cond | Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
| Jan19/87 | Y | 3 | 22190 | 1669 | 1194 | 23400 | -2404 | Jan08/87 Calibrated using 'new' |
| Jan20/87 | Y | 3 | 23478 | 1778 | 1272 | 24372 | -2166 | technique. |
| Jan26/87 | N | 3 |  |  |  | 21132 |  | Jan26/87 Point in comm. failure #1. |
| Feb13/87 | Y | 3 | 20626 | 2956 | 2114 | 22932 | -4420 |  |
| Feb18/87 | Y | 3 | 23781 | 2479 | 1773 | 23508 | 2046 | Feb17/87 Instrument recalibrated |
| Feb19/87 | Y | 3 | 21783 | 1816 | 1299 | 22032 | -1548 | (Devco Method) feb 17. |
| Feb20/87 | Y | 3 | 21450 | 1887 | 1350 | 22788 | -2688 |  |
| Feb23/87 | Y | 3 | 18786 | 3111 | 2225 | 22572 | -6011 |  |
| Feb24/87 | Y | 3 | 17958 | 2327 | 1665 | 22344 | -6051 |  |
| Feb25/87 | Y | 3 | 18970 | 1626 | 1163 | 23220 | -5413 |  |
| Mar02/87 | Y | 3 | 19154 | 1801 | 1288 | 23436 | -5570 |  |
| Mar16/87 | Y | 3 | 18050 | 1506 | 1077 | 21078 | -4105 |  |
| Mar30/87 | Y | 3 | 22742 | 1080 | 773 | 20772 | 2743 |  |
| Apr06/87 | Y | 3 | 27250 | 1626 | 1163 | 23580 | 4633 |  |
| May06/87 | N | 3 | 26667 | 2477 | 1772 | 27072 | -2177 | May06/87 Output very high when |
| May12/87 | Y | 3 | 29636 | 1482 | 1060 | 25380 | 5316 | blocked. |
| May14/87 | Y | 3 | 29006 | 1304 | 933 | 26244 | 3695 |  |
| May14/87 | Y | 3 | 33866 | 2582 | 1847 | 36324 | -4305 | May14/87 Landing door open thereby |
| May15/87 | Y | 3 | 27836 | 2172 | 1554 | 26244 | 3146 | increasing the air volume at the |
| May19/87 | Y | 3 | 26846 | 1142 | 817 | 24084 | 3579 | point. |
| May19/87 | Y | 3 | 27116 | 1632 | 1167 | 24948 | 3335 | May14-15/87 Output did not drop to |
|  |  |  |  |  |  |  |  | near zero when blocked. |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 357    DESCRIPTOR: 9E Study: Airflow 2    INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 15 | 60% | 47227 | 2923 | 2091 | 40736 | 6964 |
| 2 | 3 | 100% | 21492 | 1974 | 1340 | 21502 | 131 |
| 3 | 25 | 100% | 27313 | 3953 | 2827 | 30638 | -5443 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jul07/86 | Y | 1 | 47914 | 4259 | 3046 | 39270 | 11690 | |
| Jul15/86 | Y | 1 | 47672 | 1866 | 1335 | 39130 | 9877 | Jul24/86 communication with all of |
| Aug06/86 | Y | 1 | 46684 | 2313 | 1654 | 40860 | -3830 | trunk 2 lost at 10:00 AM. |
| Aug11/86 | Y | 1 | 50250 | 2994 | 2142 | 37660 | 14740 | Jul30/86 Trunk 2 still out. |
| Aug15/86 | N | 1 | | | | 41160 | | Jul31/86 Trunk 2 returned to service. |
| Aug19/86 | N | 1 | | | | 39480 | | Aug06/86 Main fan back on, air was |
| Aug21/86 | N | 1 | | | | 39375 | | tested without extension handle. |
| Aug25/86 | N | 1 | | | | 36995 | | Aug06/86 Main fan back on, air |
| Aug27/86 | N | 1 | | | | 36960 | | measured without extension handle. |
| Aug29/86 | N | 1 | 42824 | | | 38360 | | Aug15/86 Commun. failure. |
| Sep02/86 | Y | 1 | 50823 | 4146 | 2966 | 40670 | 13119 | Aug19/86 Commun. failure. |
| Sep04/86 | Y | 1 | 49773 | 1987 | 1421 | 40250 | 10944 | Aug21/86 Commun. failure. |
| Sep05/86 | Y | 1 | 43228 | 2493 | 1783 | 43877 | -2432 | Aug25/86 Commun. failure. |
| Sep09/86 | Y | 1 | 47286 | 3313 | 2370 | 45220 | 4356 | Aug27/86 Commun. failure. |
| Sep17/86 | Y | 1 | 45890 | 2933 | 2098 | 43776 | 4212 | Aug29/86 Output stays at 42824. |
| Jul21/86 | Y | 2 | 23189 | 1789 | 1280 | 21420 | 3049 | Jul24/86 Main fan off during |
| Jul24/86 | Y | 2 | 21008 | | | 21420 | | vacation period. |
| Jul31/86 | Y | 2 | 20280 | 1959 | 1401 | 21665 | -2786 | |
| Sep25/86 | Y | 3 | 32632 | 3562 | 2548 | 33280 | -3204 | Sep25/86 Wall switched to cundy |
| Sep30/86 | Y | 3 | 34864 | 5984 | 4280 | 41830 | -11254 | ventilation, Jtec turned around |
| Oct02/86 | Y | 3 | 26184 | 4444 | 3179 | 34990 | -11993 | because airflow was reversed. |
| Oct06/86 | Y | 3 | 24820 | 3204 | 2292 | 32452 | -9924 | The instrument was recalibrated |
| Oct20/86 | Y | 3 | 27672 | 3556 | 2544 | 30970 | -5842 | span adjustment. |
| Oct23/86 | Y | 3 | 27016 | 2026 | 1449 | 30324 | -4757 | |
| Nov14/86 | Y | 3 | 32278 | 4679 | 3347 | 23256 | 12369 | |
| Nov17/86 | Y | 3 | 27259 | 3222 | 2305 | 32330 | -7384 | |
| Nov24/86 | Y | 3 | 27176 | 3418 | 2445 | 33896 | -9165 | |
| Dec02/86 | Y | 3 | 31428 | 3885 | 2779 | 34048 | -5399 | Dec04/86 New area 70 sqft (was 76). |
| Dec23/86 | Y | 3 | 32756 | 4313 | 3085 | 31115 | 4726 | Dec22/86 Resistors installed in |
| Jan12/87 | Y | 3 | 24131 | 4502 | 3220 | 25050 | -4139 | trunk 2. |
| Jan14/87 | Y | 3 | 25003 | 4212 | 3013 | 29190 | -7200 | Jan08/87 Calibrated using the |

Point No. 357 Continued:

| | | | Conspec Reading | | | | Max. | |
|---|---|---|---|---|---|---|---|---|
| Date | Av | Cond | Mean | STD | 95%CL | Tested Value | Error @ 95%CL | Comments |
| Jan16/87 | Y | 3 | 25439 | 2996 | 2143 | 29435 | -6139 | 'Devco' method. |
| Jan19/87 | Y | 3 | 25429 | 4878 | 3489 | 29960 | -8020 | |
| Jan20/87 | Y | 3 | 26703 | 4721 | 3377 | 30940 | -7614 | |
| Jan26/87 | Y | 3 | 23519 | 3849 | 2753 | 26985 | -6219 | |
| Feb18/87 | Y | 3 | 26214 | 3680 | 2632 | 30168 | -6586 | Feb17/87 Calibrated using high span |
| Feb19/87 | Y | 3 | 25631 | 4677 | 3345 | 28525 | -6239 | method. |
| Feb20/87 | Y | 3 | 26130 | 4639 | 3318 | 28945 | -6133 | |
| Feb23/87 | Y | 3 | 24191 | 3260 | 2332 | 29050 | -7191 | |
| Feb24/87 | Y | 3 | 27994 | 3729 | 2667 | 32357 | -7030 | |
| Feb25/87 | Y | 3 | 24633 | 3771 | 2697 | 29450 | -7514 | |
| Mar02/87 | Y | 3 | 27260 | 4213 | 3014 | 30940 | -6694 | |
| Mar16/87 | Y | 3 | 26464 | 3399 | 2431 | 26425 | 2470 | |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 358 DESCRIPTOR: 9E Study: Airflow 3 INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 15 | 87% | 28364 | 1662 | 1189 | 34675 | -6409 |
| 2 | 3 | 100% | 16285 | 1343 | 961 | 16536 | -621 |
| 3 | 20 | 100% | 26316 | 1818 | 1300 | 27592 | -1995 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jul07/86 | Y | 1 | 34532 | 713 | 510 | 30888 | 4154 | |
| Jul15/86 | Y | 1 | 34465 | 1771 | 1267 | 33306 | 2426 | Jul24/86 communication with all of |
| Aug06/86 | Y | 1 | 34051 | 1691 | 1210 | 42237 | -9396 | trunk 2 lost at 10:08 AM. |
| Aug11/86 | Y | 1 | 34894 | 2181 | 1560 | 32832 | 3622 | Jul30/86 Trunk 2 still out. |
| Aug15/86 | Y | 1 | 35618 | 972 | 695 | 34788 | 1525 | Jul31/86 Trunk 2 returned to service. |
| Aug19/86 | Y | 1 | 35979 | 1992 | 1423 | 33969 | 3433 | Aug06/86 Main fan back on, air was |
| Aug21/86 | Y | 1 | 34442 | 995 | 712 | 33852 | 1302 | tested without extension handle. |
| Aug25/86 | Y | 1 | 31369 | 1811 | 1295 | 31512 | -1438 | |
| Aug27/86 | N | 1 | 5152 | 437 | 313 | 34242 | -29403 | Aug27/86 Output low. |
| Aug29/86 | N | 1 | 4068 | 476 | 340 | 33226 | -29500 | Aug29/86 Output low. |
| Sep02/86 | Y | 1 | 34804 | 5101 | 3649 | 34827 | -3672 | |
| Sep04/86 | Y | 1 | 28838 | 1927 | 1378 | 35646 | -8186 | |
| Sep05/86 | Y | 1 | 35725 | 1640 | 1173 | 35906 | -1354 | Sept05/86 New area 79 sqft (was 78), |
| Sep09/86 | Y | 1 | 37273 | 2817 | 2015 | 36393 | 2895 | point calibrated. |
| Sep17/86 | [illegible] | 1 | -244 | 428 | [illegible] | 36495 | [illegible] | |
| Jul21/86 | Y | 2 | 16814 | 762 | 545 | 16614 | 745 | Jul21/86 Main fan off during |
| Jul24/86 | Y | 2 | 16272 | | | 16614 | | vacation period. |
| Jul31/86 | Y | 2 | 15770 | 1924 | 1376 | 16380 | -1986 | |
| Sep25/86 | Y | 3 | 28327 | 1564 | 1119 | 29941 | -2733 | Sep25/86 Wall switched to cundy vent- |
| Sep30/86 | Y | 3 | 29627 | 1252 | 896 | 32035 | -3304 | ilation, Jtec turned around because |
| Oct02/86 | Y | 3 | 28927 | 2066 | 1478 | 32074 | -4625 | airflow was reversed and it |
| Oct06/86 | Y | 3 | 31027 | 3401 | 2433 | 29349 | 4111 | was calibrated. |
| Oct08/86 | Y | 3 | 26827 | 1716 | 1227 | 28717 | -3117 | |
| Oct20/86 | Y | 3 | 25227 | 1792 | 1282 | 28361 | -4416 | |
| Oct26/86 | Y | 3 | 26827 | 1509 | 1079 | 28124 | -2376 | |
| Nov14/86 | Y | 3 | 28027 | 1767 | 1264 | 28667 | -1904 | |
| Nov17/86 | Y | 3 | 25727 | 1955 | 1398 | 29112 | -4783 | |
| Nov24/86 | Y | 3 | 28227 | 1101 | 788 | 30178 | -2739 | Nov28/86 Span Adjusted. |
| Dec02/86 | Y | 3 | 27727 | 1897 | 1357 | 29309 | -2939 | Dec04/86 New area 75 sqft (was 79). |
| Dec23/86 | Y | 3 | 28927 | 2366 | 1692 | 26263 | 4356 | Dec23/86 Resistors installed in |
| Jan12/87 | Y | 3 | 25660 | 2353 | 1683 | 25050 | 2293 | trunk 2. |

Point No. 350 Continued:

| Date | Av | Cond | Conspec Reading<br>Mean | <br>STD | <br>95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jan14/87 | Y | 3 | 25228 | 1741 | 1245 | 26025 | -2042 | Jan08/87 Calibrated by Devco method. |
| Jan19/87 | Y | 3 | 24350 | 1532 | 1096 | 26625 | -3371 | |
| Jan26/87 | Y | 3 | 23133 | 1263 | 903 | 24133 | -1903 | |
| Feb13/87 | Y | 3 | 23414 | 1768 | 1265 | 24713 | -2564 | |
| Feb23/87 | Y | 3 | 22384 | 1663 | 1190 | 24225 | -3031 | |
| Mar02/87 | Y | 3 | 23414 | 1768 | 1265 | 25050 | -2901 | |
| Mar16/87 | Y | 3 | 23321 | 1882 | 1346 | 23888 | -1913 | |

# DAILY INSPECTION OF AIRFLOW SENSORS

POINT NO: 361 DESCRIPTOR: 9E Study: Airflow 6 INSTRUMENT TYPE: Jtec

## PERFORMANCE SUMMARY

| Cond. | Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 1 | 13 | 100% | 32047 | 808 | 578 | 33304 | -1678 |
| 3 | 19 | 53% | 36826 | 1547 | 1107 | 36199 | 243 |

| Date | Av | Cond | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jul07/86 | Y | 1 | 32320 | 660 | 472 | 30870 | 1922 | |
| Jul15/86 | Y | 1 | 32401 | 1107 | 792 | 33475 | -1866 | Jul24/86 communication with all of |
| Jul31/86 | Y | 1 | 32886 | 766 | 548 | 19950 | 13484 | trunk 2 lost at 10:00 AM. |
| Aug11/86 | Y | 1 | 32482 | 834 | 597 | 35910 | -4025 | Jul30/86 Trunk 2 still out. |
| Aug15/86 | Y | 1 | 34017 | 459 | 328 | 35280 | -1591 | Jul31/86 Trunk 2 returned to service. |
| Aug19/86 | Y | 1 | 32805 | 781 | 559 | 35910 | -3664 | |
| Aug21/86 | Y | 1 | 33451 | 1022 | 731 | 36542 | -3822 | |
| Aug25/86 | Y | 1 | 32643 | 948 | 678 | 34335 | -2370 | |
| Aug27/86 | Y | 1 | 32320 | 762 | 545 | 36680 | -4905 | |
| Aug29/86 | Y | 1 | 32320 | 1320 | 944 | 37905 | -6529 | |
| Sep02/86 | Y | 1 | 32078 | 545 | 390 | 37835 | -6147 | |
| Sep05/86 | Y | 1 | 27769 | 731 | 523 | 28889 | -1643 | Sep05/86 New area 56 sqft (70). |
| Sep09/86 | Y | 1 | 29121 | 564 | 403 | 29372 | -654 | point calibrated. |
| [illegible] | | 3 | 35374 | 1150 | 828 | 37820 | [illegible] | Sept25/86 Wall or [illegible] ventilation. |
| [illegible] | [illegible] | 3 | 33222 | 1271 | 912 | [illegible] | [illegible] | Jtec calibrated. |
| Oct02/86 | Y | 3 | 30352 | 1620 | 1159 | 36932 | -7739 | Oct02/86 Tried recalibration; no |
| Oct27/86 | Y | 3 | 54582 | 1410 | 1009 | 33852 | 21739 | response, span adjustment did not |
| Nov17/86 | N | 3 | | | | 34468 | | work, also no response when blocked. |
| Dec23/86 | Y | 3 | 36432 | 969 | 693 | 32984 | 4141 | Oct08/86 responds to blocking but |
| Jan12/87 | Y | 3 | 34845 | 1999 | 1430 | 34740 | 1527 | unable to calibrate to correct |
| Jan14/87 | Y | 3 | 35740 | 1547 | 1107 | 36456 | -1815 | output. |
| Jan19/87 | Y | 3 | 37797 | 1239 | 886 | 34468 | 4215 | Nov18/86 Provides output but does |
| Jan26/87 | N | 3 | | | | | | not respond to blocking. |
| Feb13/87 | N | 3 | | | | | | Dec04/86 New area 56 sqft (was 56). |
| Feb23/87 | N | 3 | | | | | | Dec22/86 Resistors installed in |
| Mar02/87 | N | 3 | | | | | | trunk 2. |
| Mar16/87 | N | 3 | | | | | | |
| Apr06/87 | N | 3 | | | | | | |
| Apr22/87 | Y | 3 | 30672 | 1797 | 1285 | 39200 | -9813 | |
| May05/87 | Y | 3 | 35503 | 1781 | 1274 | 38080 | -3851 | May06/87 Output high and low when |
| May06/87 | N | 3 | 37851 | 2230 | 1595 | 38220 | -1964 | blocked. |
| Jun03/87 | N | 3 | | | | | | Jun03/87 Communications failure. |

```
POINT NO: 366            DESCRIPTOR:   9 East Study: Airflow 4        INSTRUMENT TYPE:   Jtec
==========================================================================================

                                PERFORMANCE SUMMARY
           ###################################################################
           *                             Average Conspec Reading    Av.    Max.   *
           *        Total             ========================   Tested  Error  *
           * Cond.  Insp.   Avail.   Mean      STD     95%CL    Value  @ 95%CL *
           *===============================================================    *
           *   3      3        0%   43610     3240     2318     32076   N/A    *
           ###################################################################

==========================================================================================
                          Conspec Reading                    Max.
                    =========================   Tested   Error
   Date     Av   Cond     Mean      STD     95%CL    Value   @ 95%CL Comments
==========================================================================================
 May06/87   N     3                             0                 0  May06/87 High output when blocked or
 May22/87   N     3      43610     3240      2318     32076     N/A   unblocked.
 Jun02/87   N     3                             0                 0  May22/87 High output when blocked.
                                                                     Jun02/87 High output when blocked; no
                                                                      airflow measurement taken because of
                                                                      material piled around instrument.
```

# Appendix 2

```
*********************************************
* OVERALL PERFORMANCE OF BM1 METHANE DETECTORS *
*              (Trend Log Data)              *
*===========================================*
* Total Instruments                       18 *
* Total Inspections                      286 *
* Average Error (95% CL) (weighted) -0.00047 *
* Availability                           98%*
*********************************************
```

## PERFORMANCE SUMMARY BY INSTRUMENT

| Point No. | Descriptor | Total Insp. | Avail. | Average Conspec Reading | | | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Mean | STD | 95%CL | | | |
| 203/011 | 10 E Top Level | 22 | 100% | 0.94 | 0.0154 | 0.0191 | 0.94 | 0.98 | -0.0509 |
| 200/012 | 10 E Coal Road | 19 | 100% | 0.16 | 0.0077 | 0.0096 | 0.17 | 0.16 | -0.0002 |
| 041 | 6 W Top Level | 18 | 100% | 0.57 | 0.0130 | 0.0161 | 0.59 | 0.57 | -0.0066 |
| 042 | 6 W Coal Road | 14 | 100% | 0.22 | 0.0083 | 0.0103 | 0.22 | 0.20 | 0.0163 |
| 071 | 9 E Top Level | 7 | 100% | 0.60 | 0.0095 | 0.0118 | 0.61 | 0.59 | 0.0260 |
| 072 | 9 E Coal Road | 16 | 88% | 0.11 | 0.0100 | 0.0125 | 0.11 | 0.11 | -0.0079 |
| 108/225 | Main Fan: Xcut | 16 | 100% | 0.74 | 0.0119 | 0.0148 | 0.70 | 0.70 | 0.0228 |
| 109/231 | Main Fan: 2 Deep | 9 | 100% | 0.69 | 0.0105 | 0.0131 | 0.72 | 0.64 | 0.0601 |
| 012/200 | 8 E Coal Road | 15 | 100% | 0.60 | 0.0249 | 0.0309 | 0.60 | 0.64 | -0.0338 |
| 011/203 | 8 E Top Level | 18 | 100% | 0.94 | 0.0104 | 0.0129 | 0.91 | 0.99 | -0.0620 |
| 350 | 9 E Study: Methane 1 | 27 | 96% | 0.47 | 0.0096 | 0.0119 | 0.46 | 0.49 | 0.0011 |
| 351 | 9 E Study: Methane 2 | 31 | 94% | 0.47 | 0.0242 | 0.0301 | 0.44 | 0.46 | -0.0022 |
| 352 | 9 E Study: Methane 3 | 29 | 97% | 0.50 | 0.0105 | 0.0130 | 0.51 | 0.52 | -0.0033 |
| 353 | 9 E Study: Methane 4 | 10 | 100% | 0.34 | 0.0081 | 0.0101 | 0.21 | 0.31 | 0.0351 |
| 355 | 9 E Study: Methane 6 | 23 | 100% | 0.22 | 0.0087 | 0.0108 | 0.22 | 0.14 | 0.0895 |
| 363 | 9 ES: Top Landing | 3 | 100% | 0.10 | 0.0079 | 0.0098 | 0.07 | 0.10 | 0.0043 |
| 364 | 9 ES: Top Inside | 3 | 100% | 0.74 | 0.1547 | 0.1921 | 0.74 | 0.82 | -0.2654 |
| 71A | 9 E Inside Cundy | 6 | 100% | 0.89 | 0.0239 | 0.0297 | 0.89 | 0.89 | 0.0046 |

## DAILY INSPECTION OF METHANE IN AIR SENSORS (3M1) BY TREND LOG DATA

POINT NO: 203/011 DESCRIPTOR: 10 E Top Level Methane INSTRUMENT TYPE: 3M1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading<br>Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 22 | 100% | 0.94 | 0.0154 | 0.0191 | 0.94 | 0.98 | -0.0509 |

| Date | Av | Conspec Reading<br>Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun03/86 | Y | 1.02 | 0.0493 | 0.0612 | 1.08 | 1.05 | -0.0912 | |
| Jun17/86 | Y | 0.83 | 0.0168 | 0.0209 | 0.82 | 0.90 | -0.0909 | |
| Jul14/86 | Y | 0.69 | 0.0081 | 0.0101 | 0.68 | 0.60 | 0.1001 | |
| Jul18/86 | Y | 1.08 | 0.0123 | 0.0153 | 1.09 | 1.10 | -0.0353 | |
| Jul28/86 | Y | 0.75 | 0.0104 | 0.0129 | 0.76 | 0.75 | 0.0129 | |
| Aug18/86 | Y | 0.63 | 0.0317 | 0.0394 | 0.63 | 0.65 | -0.0594 | |
| Aug28/86 | Y | 1.09 | 0.0123 | 0.0153 | 1.01 | 1.20 | -0.1253 | |
| Sep16/86 | Y | 0.88 | 0.0132 | 0.0164 | 0.89 | 1.00 | -0.1364 | |
| Sep19/86 | Y | 0.95 | 0.0354 | 0.0439 | 0.93 | 1.20 | -0.2939 | |
| Sep23/86 | Y | 0.54 | 0.0081 | 0.0101 | 0.56 | 0.60 | -0.0701 | |
| Oct01/86 | Y | 0.80 | 0.0081 | 0.0101 | 0.80 | 0.80 | 0.0101 | |
| Oct21/86 | Y | 0.71 | 0.0132 | 0.0164 | 0.68 | 0.65 | 0.0764 | Oct24/86 New point no.; 011 (was 203). |
| Dec16/86 | Y | 0.91 | 0.0123 | 0.0153 | 0.91 | 0.90 | 0.0253 | |
| Jan28/87 | Y | 0.90 | 0.0147 | 0.0183 | 0.95 | 1.05 | -0.1683 | |
| Feb10/87 | Y | 1.01 | 0.0000 | 0.0000 | 1.03 | 1.00 | 0.0100 | |
| Feb20/87 | Y | 1.91 | 0.0161 | 0.0200 | 1.89 | 1.95 | -0.0620 | |
| Feb24/87 | Y | 1.15 | 0.0066 | 0.0082 | 1.12 | 1.15 | 0.0082 | |
| Feb25/87 | Y | 1.03 | 0.0147 | 0.0183 | 1.10 | 1.10 | -0.0883 | |
| Mar03/87 | Y | 0.99 | 0.0132 | 0.0164 | 1.00 | 1.00 | -0.0264 | |
| Mar09/87 | Y | 0.83 | 0.0132 | 0.0164 | 0.81 | 0.85 | -0.0364 | |
| Mar10/87 | Y | 0.93 | 0.0192 | 0.0238 | 0.89 | 1.00 | -0.0938 | |
| May22/87 | Y | 1.00 | 0.0104 | 0.0129 | 1.02 | 1.00 | 0.0129 | |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 200/012 DESCRIPTOR: 10 E Coal Road Methane INSTRUMENT TYPE: BM1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | Average Conspec Reading STD | Average Conspec Reading 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 19 | 100% | 0.16 | 0.0077 | 0.0096 | 0.17 | 0.16 | -0.0002 |

| Date | Av | Conspec Reading Mean | Conspec Reading STD | Conspec Reading 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun17/86 | Y | 0.17 | 0.0066 | 0.0082 | 0.20 | 0.20 | -0.0382 | |
| Jul14/86 | Y | 0.10 | 0.0066 | 0.0082 | 0.12 | 0.15 | -0.0582 | |
| Jul18/86 | Y | 0.15 | 0.0081 | 0.0101 | 0.19 | 0.20 | -0.0601 | |
| Jul28/86 | Y | 0.20 | 0.0081 | 0.0101 | 0.21 | 0.21 | -0.0201 | Jul28/86 Low D6 battery; Tested=Local |
| Aug18/86 | Y | 0.12 | 0.0066 | 0.0082 | 0.16 | 0.20 | -0.0882 | |
| Aug28/86 | Y | 0.11 | 0.0066 | 0.0082 | 0.12 | 0.10 | 0.0182 | |
| Sep16/86 | Y | 0.12 | 0.0000 | 0.0000 | 0.13 | 0.10 | 0.0200 | |
| Sep19/86 | Y | 0.17 | 0.0066 | 0.0082 | 0.20 | 0.20 | -0.0382 | |
| Sep23/86 | Y | 0.14 | 0.0066 | 0.0082 | 0.16 | 0.10 | 0.0482 | |
| Oct01/86 | Y | 0.11 | 0.0081 | 0.0101 | 0.13 | 0.20 | -0.1001 | |
| Oct21/86 | Y | 0.14 | 0.0123 | 0.0153 | 0.15 | 0.10 | 0.0553 | |
| Oct27/86 | Y | 0.14 | 0.0066 | 0.0082 | 0.13 | 0.10 | 0.0482 | |
| Nov18/86 | Y | 0.15 | 0.0081 | 0.0101 | 0.15 | 0.15 | 0.0101 | |
| Nov24/86 | Y | 0.18 | 0.0066 | 0.0082 | 0.13 | 0.10 | 0.0882 | |
| Dec16/86 | Y | 0.15 | 0.0081 | 0.0101 | 0.17 | 0.15 | 0.0101 | |
| Jan28/87 | Y | 0.21 | 0.0081 | 0.0101 | 0.20 | 0.20 | 0.0201 | |
| Feb10/87 | Y | 0.32 | 0.0123 | 0.0153 | 0.31 | 0.25 | 0.0853 | |
| Mar09/87 | Y | 0.17 | 0.0123 | 0.0153 | 0.16 | 0.20 | -0.0453 | |
| Mar10/87 | Y | 0.23 | 0.0081 | 0.0101 | 0.21 | 0.20 | 0.0401 | |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (3M1) BY TREND LOG DATA

POINT NO: 241 DESCRIPTOR: 6 W Top Level Methane INSTRUMENT TYPE: 3M1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 18 | 100% | 0.57 | 0.0130 | 0.0161 | 0.59 | 0.57 | -0.0066 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun03/86 | Y | 0.79 | 0.0081 | 0.0101 | 0.79 | 0.80 | -0.0201 | |
| Jun17/86 | Y | 0.67 | 0.0263 | 0.0327 | 0.70 | 0.70 | -0.0627 | |
| Jul14/86 | Y | 0.34 | 0.0800 | 0.0993 | 0.42 | 0.40 | -0.1593 | |
| Jul18/86 | Y | 0.52 | 0.0081 | 0.0101 | 0.54 | 0.55 | -0.0401 | |
| Jul28/86 | Y | 0.57 | 0.0066 | 0.0082 | 0.60 | 0.60 | -0.0382 | Jul28/86 Low d6 battery; Tested=Local. |
| Aug18/86 | Y | 0.50 | 0.0066 | 0.0082 | 0.52 | 0.50 | 0.0082 | |
| Aug28/86 | Y | 0.49 | 0.0081 | 0.0101 | 0.51 | 0.55 | -0.0701 | |
| Sep16/86 | Y | 0.60 | 0.0081 | 0.0101 | 0.62 | 0.60 | 0.0101 | |
| Sep19/86 | Y | 0.72 | 0.0066 | 0.0082 | 0.75 | 0.70 | 0.0282 | |
| Sep23/86 | Y | 0.50 | 0.0104 | 0.0129 | 0.52 | 0.50 | 0.0129 | |
| Oct01/86 | Y | 0.72 | 0.0066 | 0.0082 | 0.75 | 0.55 | 0.1782 | |
| Jan20/87 | Y | 0.48 | 0.0081 | 0.0101 | 0.47 | 0.45 | 0.0401 | |
| Feb03/87 | Y | 0.48 | 0.0081 | 0.0101 | 0.46 | 0.45 | 0.0401 | |
| Mar03/87 | Y | 0.62 | 0.0123 | 0.0153 | 0.65 | 0.65 | -0.0453 | |
| Mar09/87 | Y | 0.54 | 0.0081 | 0.0101 | 0.56 | 0.55 | -0.0201 | |
| Mar10/87 | Y | 0.57 | 0.0066 | 0.0082 | 0.60 | 0.60 | -0.0382 | |
| Mar17/87 | Y | 0.54 | 0.0081 | 0.0101 | 0.56 | 0.55 | -0.0201 | |
| May19/87 | Y | 0.57 | 0.0066 | 0.0082 | 0.61 | 0.50 | 0.0782 | |

```
             DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA
             ==================================================================

POINT NO: 042            DESCRIPTOR:  6 W Coal Road Methane           INSTRUMENT TYPE:     BM1
==========================================================================================

                                  PERFORMANCE SUMMARY
               ****************************************************************
               *                Average Conspec Reading    Av.      Av.     Max.   *
               * Total          ======================    Local    Tested   Error  *
               * Insp.  Avail.   Mean    STD     95%CL    Value    Value   @ 95%CL *
               *=============================================================== *
               *  14     100%    0.22   0.0083  0.0103    0.22     0.20   0.0163  *
               ****************************************************************

==========================================================================================
                   Conspec Reading                            Max.
              ======================== Local    Tested    Error
  Date    Av   Mean    STD      95%CL    Value    Value    @ 95%CL Comments
==========================================================================================
 Jun17/86  Y  0.26   0.0081   0.0101     0.25     0.25    0.0201
 Jul14/86  Y  0.14   0.0081   0.0101     0.15     0.15   -0.0201
 Jul18/86  Y  0.24   0.0081   0.0101     0.22     0.20    0.0501
 Jul28/86  Y  0.26   0.0081   0.0101     0.25     0.25    0.0201  Jul28/86 Low D6 battery; Tested=Local.
 Aug18/86  Y  0.21   0.0081   0.0101     0.20     0.20    0.0201
 Sep16/86  Y  0.18   0.0081   0.0101     0.19     0.20   -0.0321
 Sep19/86  Y  0.24   0.0132   0.0164     0.25     0.25   -0.0264
 Sep23/86  Y  0.22   0.0066   0.0082     0.20     0.20    0.0282
 Oct21/86  Y  0.18   0.0066   0.0082    [illegible] [illegible] -0.0282
 Nov18/86  Y  0.18   0.0123   0.0153     0.22     0.20   -0.0353
 Feb23/87  Y  0.26   0.0081   0.0101     0.24     0.20    0.0721
 Mar03/87  Y  0.24   0.0081   0.0101     0.22     0.20    0.0521
 Mar17/87  Y  0.24   0.0066   0.0082     0.25     0.25   -0.0182
 May19/87  Y  0.22   0.0066   0.0082     0.20     0.10    0.1282
```

## DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 071 DESCRIPTOR: 9 E Top Level Methane INSTRUMENT TYPE: BM1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading | | | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| | | Mean | STD | 95%CL | | | |
| 7 | 100% | 0.60 | 0.0095 | 0.0118 | 0.61 | 0.59 | 0.0260 |

| Date | Av | Conspec Reading | | | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Mean | STD | 95%CL | | | | |
| Jun04/86 | Y | 0.68 | 0.0300 | 0.0372 | 0.69 | 0.65 | 0.0672 | |
| Jun06/86 | Y | 0.62 | 0.0013 | 0.0016 | 0.62 | 0.60 | 0.0216 | |
| Jun12/86 | Y | 0.46 | 0.0066 | 0.0082 | 0.48 | 0.40 | 0.0682 | |
| Jun16/86 | Y | 0.49 | 0.0000 | 0.0000 | 0.50 | 0.50 | -0.0100 | |
| Jun18/86 | Y | 0.64 | 0.0081 | 0.0101 | 0.63 | 0.60 | 0.0501 | |
| Jul07/86 | Y | 0.55 | 0.0123 | 0.0153 | 0.55 | 0.55 | 0.0153 | |
| Jul30/86 | Y | 0.78 | 0.0081 | 0.0101 | 0.79 | 0.80 | -0.0301 | |

## DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 072 DESCRIPTOR: 9 E Coal Road Methane INSTRUMENT TYPE: BM1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 16 | 88% | 0.11 | 0.0100 | 0.0125 | 0.11 | 0.11 | -0.0079 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun04/86 | Y | 0.08 | 0.0081 | 0.0101 | 0.08 | 0.10 | -0.0301 | |
| Jun06/86 | Y | 0.08 | 0.0131 | 0.0163 | 0.10 | 0.10 | -0.0363 | |
| Jun12/86 | Y | 0.07 | 0.0104 | 0.0129 | | 0.10 | -0.0429 | |
| Jun16/86 | Y | 0.08 | 0.0081 | 0.0101 | 0.10 | 0.10 | -0.0301 | |
| Jun18/86 | Y | 0.09 | 0.0081 | 0.0101 | 0.10 | 0.10 | -0.0221 | |
| Jul07/86 | Y | 0.09 | 0.0081 | 0.0101 | 0.10 | 0.10 | -0.0221 | |
| Jul15/86 | Y | 0.21 | 0.0066 | 0.0082 | 0.20 | 0.20 | 0.0182 | |
| Jul24/86 | N | | | | | | | Jul24/86 BM1 removed; used |
| Jul30/86 | N | | | | | | | to monitor main fan. |
| Feb06/87 | Y | 0.08 | 0.0081 | 0.0101 | 0.09 | 0.10 | -0.0321 | Jul30/86 BM1 still not returned. |
| Feb24/87 | Y | 0.12 | 0.0123 | 0.0153 | 0.10 | 0.10 | 0.0353 | |
| Mar03/87 | Y | 0.08 | 0.0081 | 0.0101 | 0.09 | 0.10 | -0.0301 | |
| Mar17/87 | Y | 0.15 | 0.0000 | 0.0000 | 0.15 | 0.15 | 0.0000 | |
| Apr22/87 | Y | 0.15 | 0.0123 | 0.0153 | 0.12 | 0.05 | 0.1153 | |
| May06/87 | Y | 0.12 | 0.0066 | 0.0082 | 0.12 | 0.10 | 0.0282 | |
| Jun03/87 | Y | 0.07 | 0.0305 | 0.0379 | 0.08 | 0.10 | -0.0679 | |

## DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 100/225 DESCRIPTOR: Fan Airway Methane INSTRUMENT TYPE: BM1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading<br>Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 16 | 100% | 0.74 | 0.0119 | 0.0148 | 0.70 | 0.70 | 0.0228 |

| Date | Av | Conspec Reading<br>Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Aug15/86 | Y | 0.82 | 0.0147 | 0.0183 | | 0.85 | -0.0483 | |
| Aug22/86 | Y | 0.86 | 0.0168 | 0.0209 | | 0.95 | -0.1109 | |
| Sep18/86 | Y | 0.80 | 0.0168 | 0.0209 | | 0.85 | -0.0709 | |
| Sep26/86 | Y | 0.80 | 0.0081 | 0.0101 | | 0.80 | 0.0101 | |
| Oct03/87 | Y | 0.64 | 0.0066 | 0.0082 | | 0.60 | 0.0482 | |
| Oct10/86 | Y | 0.64 | 0.0123 | 0.0153 | 0.62 | 0.60 | 0.0553 | |
| Nov05/86 | Y | 0.62 | 0.0000 | 0.0000 | 0.60 | 0.60 | 0.0200 | |
| Dec24/86 | Y | 1.11 | 0.0132 | 0.0164 | 1.10 | 1.00 | 0.1264 | |
| Dec19/86 | Y | 0.65 | 0.0066 | 0.0082 | 0.60 | 0.50 | 0.1582 | |
| Jan27/87 | Y | 0.32 | 0.0366 | 0.0454 | 0.32 | 0.45 | -0.1754 | |
| Jan30/87 | Y | 0.73 | 0.0131 | 0.0163 | 0.71 | 0.60 | 0.1463 | |
| Feb09/87 | Y | 0.51 | 0.0123 | 0.0153 | 0.51 | 0.45 | 0.0753 | |
| Feb27/87 | Y | 0.74 | 0.0066 | 0.0082 | 0.72 | | | Feb27/87 Not checked by DG. |
| Mar06/97 | Y | 0.93 | 0.0104 | 0.0129 | 0.90 | | | Mar06/87 Not checked by DG. |
| Mar13/87 | Y | 0.93 | 0.0081 | 0.0101 | 0.90 | 0.85 | 0.0921 | |
| Mar20/87 | Y | 0.73 | 0.0081 | 0.0101 | 0.72 | 0.70 | 0.0421 | |

```
                 DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA
                 ==================================================================

POINT NO:  109/231          DESCRIPTOR:  2 Deep Methane                      INSTRUMENT TYPE:     BM1
=======================================================================================================

                                        PERFORMANCE SUMMARY
               ********************************************************************************
               *                    Average Conspec Reading        Av.        Av.      Max.   *
               * Total              =========================     Local      Tested    Error   *
               * Insp.   Avail.     Mean      STD      95%CL      Value      Value    @ 95%CL  *
               *========================================================================== *
               *   9      100%      0.69    0.0105    0.0131      0.72       0.64    0.0601   *
               ********************************************************************************

=======================================================================================================
                    Conspec Reading                            Max.
              ==========================  Local    Tested     Error
   Date     Av   Mean     STD      95%CL     Value    Value     @ 95%CL Comments
=======================================================================================================
 Dec18/86   Y  0.64   0.0168   0.0209     0.65     0.50    0.1609
 Jan07/87   Y  0.49   0.0081   0.0101     0.53     0.45    0.0501
 Jan30/87   Y  0.71   0.0123   0.0153     0.73     0.70    0.0253
 Feb09/87   Y  0.59   0.0066   0.0082     0.62     0.50    0.0982
 Feb27/87   Y  0.72   0.0123   0.0153     0.77     0.65    0.0853
 Mar06/87   Y  0.84   0.0123   0.0153     0.66     0.85   -0.0253
 Mar10/87   Y  0.67   0.0132   0.0164     0.69     0.62    0.0664
 Mar13/87   Y  0.89   0.0266   0.0281     0.92     0.92    0.2981
 Mar2[illegible]/87      [illegible]   0.0266   0.0281     [illegible]     0.72   -0.0781
```

## DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 012/200 DESCRIPTOR: 8 East Coal Road Methane INSTRUMENT TYPE: BM1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 15 | 100% | 0.60 | 0.0249 | 0.0309 | 0.60 | 0.64 | -0.0338 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jun05/86 | Y | 0.07 | 0.0000 | 0.0000 | 0.08 | 0.10 | -0.0300 | |
| Jul10/86 | Y | 0.07 | 0.0066 | 0.0082 | 0.10 | 0.10 | -0.0382 | |
| Sep19/86 | Y | 0.13 | 0.0081 | 0.0101 | 0.12 | 0.10 | 0.0401 | |
| Sep23/86 | Y | 0.65 | 0.0132 | 0.0164 | 0.65 | 0.70 | -0.0664 | Sept 20/86 9 East cundy ventilation |
| Oct01/86 | Y | 0.60 | 0.0132 | 0.0164 | 0.59 | 0.60 | 0.0164 | returns through 8 East. |
| Oct07/86 | Y | 0.59 | 0.0066 | 0.0082 | 0.59 | 0.55 | 0.0482 | |
| Oct09/86 | Y | 0.57 | 0.0000 | 0.0000 | 0.62 | 0.60 | -0.0300 | |
| Oct15/86 | Y | 0.79 | 0.1320 | 0.1639 | 0.79 | 0.80 | -0.1739 | |
| Oct21/86 | Y | 0.67 | 0.0066 | 0.0082 | 0.67 | 0.65 | 0.0282 | |
| Nov18/86 | Y | 0.70 | 0.0710 | 0.0881 | 0.67 | 0.70 | 0.0881 | Oct27/86 New point no.; 200 |
| Jan26/87 | Y | 1.41 | 0.0825 | 0.1024 | 1.35 | 1.40 | 0.1124 | (was 012). |
| Feb19/87 | Y | 0.66 | 0.0123 | 0.0153 | 0.68 | 0.75 | -0.1053 | |
| Mar17/87 | Y | 0.61 | 0.0066 | 0.0082 | 0.61 | 0.80 | -0.1982 | |
| Mar24/87 | Y | 0.57 | 0.0066 | 0.0082 | 0.58 | 0.70 | -0.1382 | |
| May22/87 | Y | 0.95 | 0.0081 | 0.0101 | 0.93 | 1.00 | -0.0601 | |

## DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 011/203 DESCRIPTOR: 8 East Top Level Methane INSTRUMENT TYPE: BM1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading | | | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| | | Mean | STD | 95%CL | | | |
| 18 | 100% | 0.94 | 0.0104 | 0.0129 | 0.91 | 0.99 | -0.0620 |

| Date | Av | Conspec Reading | | | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Mean | STD | 95%CL | | | | |
| Jun05/86 | Y | 1.00 | 0.0104 | 0.0129 | 1.00 | 0.90 | 0.1129 | |
| Jul10/86 | Y | 0.91 | 0.0081 | 0.0101 | 0.90 | 0.90 | 0.0201 | |
| Aug14/86 | Y | 1.06 | 0.0000 | 0.0000 | 1.04 | 1.15 | -0.0900 | |
| Sep19/86 | Y | 0.15 | 0.0081 | 0.0101 | 0.10 | 0.10 | 0.0601 | Sep19/86 Point moved to 8 East top |
| Sep23/86 | Y | 1.15 | 0.0081 | 0.0101 | 1.12 | 1.30 | -0.1601 | fire seal. |
| Sep23/86 | Y | 1.21 | 0.0161 | 0.0200 | 1.15 | 1.30 | -0.1100 | Sep20-21/86 9 East cundy ventilation |
| Oct01/86 | Y | 0.96 | 0.0123 | 0.0153 | 0.93 | 1.00 | -0.0553 | returns through 8 East. |
| Oct07/86 | Y | 0.85 | 0.0104 | 0.0129 | 0.85 | 0.90 | -0.0629 | |
| Oct09/86 | Y | 0.83 | 0.0263 | 0.0327 | 0.80 | 0.85 | -0.0527 | |
| Oct15/86 | Y | 1.02 | 0.0081 | 0.0101 | 1.00 | 1.05 | -0.0401 | |
| Oct21/86 | Y | 0.76 | 0.0104 | 0.0129 | 0.75 | 0.80 | -0.0529 | Oct27/86 New point no. 203 (was 011). |
| Nov18/86 | Y | 0.94 | 0.0000 | 0.0000 | 0.85 | 0.90 | 0.0400 | Nov7-21/86 Output from point was |
| Jan26/87 | Y | 1.46 | 0.0132 | 0.0164 | 1.43 | 1.65 | -0.2064 | frozen on 0.9403 during this |
| Feb19/87 | Y | 0.92 | 0.0081 | 0.0101 | 0.88 | 0.90 | 0.0301 | period because no address was |
| Mar10/87 | Y | 0.84 | 0.0123 | 0.0153 | 0.80 | 1.00 | -0.1753 | assigned to point no. 203. The |
| Mar17/87 | Y | 0.85 | 0.0123 | 0.0153 | 0.83 | 1.00 | -0.1653 | computer continued to display 0.9403 |
| Mar24/87 | Y | 0.80 | 0.0168 | 0.0209 | 0.76 | 0.95 | -0.1709 | until an address was assigned on |
| May22/87 | Y | 1.17 | 0.0066 | 0.0082 | 1.14 | 1.20 | -0.0382 | Nov 21/86. |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 350 DESCRIPTOR: 9 East Study: Methane 1 INSTRUMENT TYPE: BM1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 27 | 96% | 0.47 | 0.0096 | 0.0119 | 0.46 | 0.49 | 0.0011 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jul15/86 | N | | | | 1.06 | 0.95 | | |
| Jul21/86 | Y | 1.09 | 0.0131 | 0.0163 | 1.05 | 1.00 | 0.1063 | Jul24/86 communication with all of |
| Jul31/86 | Y | 0.86 | 0.0100 | 0.0124 | 0.84 | 0.75 | 0.1224 | trunk 2 lost at 10:00 AM. |
| Aug15/86 | Y | 0.88 | 0.0066 | 0.0082 | 0.85 | 0.90 | -0.0282 | Jul30/86 Trunk 2 still out. |
| Aug19/86 | Y | 0.75 | 0.0066 | 0.0082 | 0.72 | 0.70 | 0.0582 | Jul31/86 Trunk 2 returned to service. |
| Aug21/86 | Y | 0.94 | 0.0104 | 0.0129 | 0.86 | 1.00 | -0.0729 | |
| Aug25/86 | Y | 0.80 | 0.0081 | 0.0101 | 0.78 | 0.80 | 0.0101 | |
| Aug27/86 | Y | 0.73 | 0.0192 | 0.0238 | 0.70 | 0.80 | -0.0938 | |
| Aug29/86 | Y | 0.82 | 0.0123 | 0.0153 | 0.75 | 0.90 | -0.0953 | |
| Sep02/86 | Y | 0.62 | 0.0081 | 0.0101 | 0.61 | 0.70 | -0.0901 | |
| Sep04/86 | Y | 0.81 | 0.0104 | 0.0129 | 0.79 | 0.90 | -0.1029 | |
| Sep09/86 | Y | 0.67 | 0.0081 | 0.0101 | 0.64 | 0.75 | -0.0901 | |
| Sep17/86 | Y | 0.76 | 0.0132 | 0.0164 | 0.75 | 1.00 | -0.2564 | |
| Sep25/86 | Y | 0.17 | 0.0123 | 0.0153 | 0.16 | 0.10 | 0.0853 | Sep20/86 Wall on Cundy Ventilation. |
| Sep30/86 | Y | 0.19 | 0.0081 | 0.0101 | 0.17 | 0.15 | 0.0501 | |
| Oct02/86 | Y | 0.16 | 0.0066 | 0.0082 | 0.15 | 0.15 | 0.0182 | |
| Oct06/86 | Y | 0.15 | 0.0132 | 0.0164 | 0.12 | 0.15 | 0.0164 | |
| Oct08/86 | Y | 0.15 | 0.0081 | 0.0101 | 0.10 | 0.10 | 0.0601 | |
| Oct15/86 | Y | 0.17 | 0.0081 | 0.0101 | 0.13 | 0.10 | 0.0801 | |
| Oct23/86 | Y | 0.19 | 0.0081 | 0.0101 | 0.13 | 0.15 | 0.0501 | |
| Nov14/86 | Y | 0.20 | 0.0081 | 0.0101 | 0.16 | 0.10 | 0.1101 | |
| Nov17/86 | Y | 0.24 | 0.0081 | 0.0101 | 0.20 | 0.20 | 0.0501 | |
| Nov24/86 | Y | 0.17 | 0.0066 | 0.0082 | 0.13 | 0.10 | 0.0782 | Dec22/86 Resistors installed in trunk. |
| Dec23/86 | Y | 0.17 | 0.0081 | 0.0101 | 0.13 | 0.15 | 0.0301 | |
| Feb13/87 | Y | 0.16 | 0.0066 | 0.0082 | 0.13 | 0.15 | 0.0182 | |
| Mar02/87 | Y | 0.21 | 0.0123 | 0.0153 | 0.19 | 0.20 | 0.0253 | |
| Mar16/87 | Y | 0.20 | 0.0081 | 0.0101 | 0.18 | 0.30 | -0.1101 | |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 351 DESCRIPTOR: 9 East Study: Methane 2 INSTRUMENT TYPE: BM1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 31 | 94% | 0.47 | 0.0242 | 0.0301 | 0.44 | 0.46 | -0.0022 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jul21/86 | Y | 0.74 | 0.0796 | 0.0988 | 0.97 | 1.00 | -0.3588 | Jul24/86 communication with all of |
| Jul31/86 | Y | 0.77 | 0.0131 | 0.0163 | 0.74 | 0.75 | 0.0363 | trunk 2 lost at 10:08 AM. |
| Aug15/86 | Y | 0.75 | 0.0123 | 0.0153 | 0.73 | 0.90 | -0.1653 | Jul30/86 Trunk 2 still out. |
| Aug19/86 | Y | 0.78 | 0.0123 | 0.0153 | 0.77 | 0.90 | -0.1353 | Jul31/86 Trunk 2 returned to service. |
| Aug21/86 | Y | 0.74 | 0.0456 | 0.0566 | 1.00 | 1.10 | -0.4166 | |
| Aug25/86 | Y | 0.84 | 0.0906 | 0.1125 | 0.86 | 0.90 | -0.1725 | |
| Aug27/86 | Y | 0.85 | 0.0104 | 0.0129 | 0.84 | 0.90 | -0.0629 | |
| Aug29/86 | Y | 0.82 | 0.0354 | 0.0439 | 0.86 | 0.90 | -0.1239 | |
| Sep02/86 | Y | 0.70 | 0.0132 | 0.0164 | 0.79 | 0.75 | -0.0664 | |
| Sep04/86 | Y | 0.80 | 0.0774 | 0.0961 | 0.89 | 1.00 | -0.2961 | |
| Sep09/86 | Y | 0.86 | 0.0081 | 0.0101 | 0.86 | 0.90 | -0.0501 | |
| Sep17/86 | Y | 0.79 | 0.0891 | 0.1106 | 0.90 | 1.00 | -0.3206 | Sep20/86 Wall placed on cundy vent- |
| Sep25/86 | N | 0.77 | 0.0700 | 0.0869 | 0.20 | 0.20 | 0.6569 | ilation. |
| Sep30/86 | N | 0.76 | 0.0611 | 0.0759 | 0.21 | 0.20 | 0.6359 | Sept25/86 Conspec output high con- |
| Oct02/86 | Y | 0.22 | 0.0081 | 0.0101 | 0.19 | 0.20 | 0.0301 | trol unit OK. |
| Oct06/86 | Y | 0.22 | 0.0081 | 0.0101 | 0.20 | 0.20 | 0.0301 | Sept30/86 Conspec output high, con- |
| Oct08/86 | Y | 0.14 | 0.0081 | 0.0101 | 0.12 | 0.10 | 0.0501 | trol unit OK. |
| Oct15/86 | Y | 0.17 | 0.0066 | 0.0082 | 0.15 | 0.15 | 0.0282 | Oct02/86 New accessor installed at |
| Oct20/86 | Y | 0.19 | 0.0074 | 0.0092 | 0.16 | 0.10 | 0.0992 | outstation; output OK. |
| Oct23/86 | Y | 0.19 | 0.0081 | 0.0101 | 0.16 | 0.15 | 0.0501 | |
| Nov15/86 | Y | 0.19 | 0.0066 | 0.0082 | 0.20 | 0.10 | 0.0982 | |
| Nov17/86 | Y | 0.24 | 0.0081 | 0.0101 | 0.21 | 0.15 | 0.1001 | |
| Nov24/86 | Y | 0.19 | 0.0000 | 0.0000 | 0.16 | 0.15 | 0.0400 | |
| Dec23/86 | Y | 0.20 | 0.0081 | 0.0101 | 0.15 | 0.15 | 0.0601 | Dec22/86 Resistors installed in trunk. |
| Jan12/87 | Y | 0.45 | 0.0132 | 0.0164 | 0.39 | 0.40 | 0.0664 | |
| Feb13/87 | Y | 0.23 | 0.0081 | 0.0101 | 0.20 | 0.20 | 0.0401 | |
| Feb18/87 | Y | 0.21 | 0.0066 | 0.0082 | 0.19 | 0.10 | 0.1182 | |
| Mar02/87 | Y | 0.20 | 0.0081 | 0.0101 | 0.17 | 0.20 | 0.0101 | |
| Mar16/87 | Y | 0.23 | 0.0081 | 0.0101 | 0.18 | 0.25 | -0.0301 | |
| Mar25/87 | Y | 0.16 | 0.0066 | 0.0082 | 0.15 | 0.10 | 0.0682 | |
| Mar30/87 | Y | 0.13 | 0.0132 | 0.0164 | 0.10 | 0.20 | -0.0064 | |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 352 DESCRIPTOR: 9 East Study: Methane 3 INSTRUMENT TYPE: BM1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 29 | 97% | 0.50 | 0.0105 | 0.0130 | 0.51 | 0.52 | -0.0033 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jul21/86 | Y | 0.86 | 0.0081 | 0.0101 | 0.83 | 0.80 | 0.0701 | Jul24/86 communication with all of |
| Jul31/86 | Y | 0.64 | 0.0066 | 0.0082 | 0.62 | 0.60 | 0.0482 | trunk 2 lost at 10:08 AM. |
| Aug15/86 | Y | 0.74 | 0.0081 | 0.0101 | 0.72 | 0.80 | -0.0701 | Jul30/86 Trunk 2 still out. |
| Aug19/86 | Y | 0.64 | 0.0066 | 0.0082 | 0.62 | 0.65 | -0.0182 | Jul31/86 Trunk 2 returned to service. |
| Aug21/86 | Y | 0.90 | 0.0166 | 0.0206 | 0.89 | 1.00 | -0.1206 | |
| Aug25/86 | Y | 0.77 | 0.0081 | 0.0101 | 0.76 | 0.90 | -0.1401 | |
| Aug27/86 | Y | 0.64 | 0.0081 | 0.0101 | 0.64 | 0.80 | -0.1701 | |
| Aug29/86 | Y | 0.69 | 0.0081 | 0.0101 | 0.67 | 0.80 | -0.1201 | |
| Sep02/86 | Y | 0.51 | 0.0081 | 0.0101 | 0.50 | 0.60 | -0.1001 | |
| Sep04/86 | Y | 0.94 | 0.0441 | 0.0548 | 0.97 | 1.00 | -0.1148 | |
| Sep09/86 | Y | 0.78 | 0.0147 | 0.0183 | 0.76 | 0.80 | -0.0383 | |
| Sep17/86 | N | | | | 0.96 | 1.05 | | |
| Sep23/86 | Y | 0.38 | 0.0066 | 0.0082 | 0.36 | 0.30 | 0.0882 | Sep20/86 Wall switched to cundy vent- |
| Sep30/86 | Y | 0.38 | 0.0147 | 0.0183 | 0.36 | 0.35 | 0.0483 | ilation, point in intake air. |
| Oct02/86 | Y | 0.37 | 0.0066 | 0.0082 | 0.35 | 0.35 | 0.0282 | |
| Oct06/86 | Y | 0.37 | 0.0161 | 0.0200 | 0.38 | 0.35 | 0.0400 | |
| Oct08/86 | Y | 0.34 | 0.0104 | 0.0129 | 0.32 | 0.30 | 0.0529 | |
| Oct20/86 | Y | 0.36 | 0.0081 | 0.0101 | 0.34 | 0.30 | 0.0701 | |
| Oct23/86 | Y | 0.37 | 0.0147 | 0.0183 | 0.35 | 0.30 | 0.0883 | |
| Nov14/86 | Y | 0.33 | 0.0081 | 0.0101 | 0.40 | 0.30 | 0.0401 | |
| Nov17/86 | Y | 0.37 | 0.0123 | 0.0153 | 0.35 | 0.30 | 0.0853 | |
| Nov24/86 | Y | 0.39 | 0.0123 | 0.0153 | 0.36 | 0.30 | 0.1053 | |
| Dec23/86 | Y | 0.30 | 0.0081 | 0.0101 | 0.30 | 0.30 | 0.0101 | Dec22/86 Resistors installed in trunk. |
| Jan12/87 | Y | 0.55 | 0.0081 | 0.0101 | 0.54 | 0.50 | 0.0601 | |
| Feb13/87 | Y | 0.22 | 0.0000 | 0.0000 | 0.21 | 0.20 | 0.0200 | |
| Mar02/87 | Y | 0.36 | 0.0066 | 0.0082 | 0.35 | 0.30 | 0.0682 | |
| Mar16/87 | Y | 0.33 | 0.0081 | 0.0101 | 0.40 | 0.40 | -0.0001 | |
| Mar17/87 | Y | 0.23 | 0.0081 | 0.0101 | 0.20 | 0.30 | -0.0801 | |
| Mar30/87 | Y | 0.23 | 0.0066 | 0.0082 | 0.20 | 0.20 | 0.0382 | |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 353 DESCRIPTOR: 9 East Study: Methane 4 INSTRUMENT TYPE: BM1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| 10 | 100% | 0.34 | 0.0081 | 0.0101 | 0.21 | 0.31 | 0.0351 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| Jan14/87 | Y | 0.44 | 0.0081 | 0.0101 | 0.41 | 0.35 | 0.1001 | |
| Jan26/87 | Y | 0.46 | 0.0123 | 0.0153 | 0.45 | 0.40 | 0.0753 | |
| Feb13/87 | Y | 0.34 | 0.0066 | 0.0082 | 0.31 | 0.30 | 0.2482 | |
| Feb23/87 | Y | 0.32 | 0.0081 | 0.0101 | 0.10 | 0.25 | 0.2801 | |
| Mar16/87 | Y | 0.42 | 0.0066 | 0.0082 | 0.21 | 0.40 | 0.0282 | |
| Mar24/87 | Y | 0.29 | 0.0081 | 0.0101 | 0.10 | 0.30 | -0.0201 | |
| Mar30/87 | Y | 0.29 | 0.0081 | 0.0101 | 0.10 | 0.30 | -0.0201 | |
| May06/87 | Y | 0.24 | 0.0073 | 0.0091 | 0.03 | 0.20 | 0.0491 | |
| May22/87 | Y | 0.24 | 0.0081 | 0.0101 | 0.32 | 0.25 | -0.0201 | |
| Jun02/87 | Y | 0.32 | 0.0081 | 0.0101 | 0.11 | 0.30 | 0.0301 | |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA

POINT NO: 355 DESCRIPTOR: 9 East Study: Methane 6 INSTRUMENT TYPE: BM1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading | | | Av. Local Value | Av. Tested Value | Max. Error @ 95%CL |
|---|---|---|---|---|---|---|---|
| | | Mean | STD | 95%CL | | | |
| 23 | 100% | 0.22 | 0.0087 | 0.0108 | 0.22 | 0.14 | 0.0895 |

| Date | Av | Conspec Reading | | | Local Value | Tested Value | Max. Error @ 95%CL | Comments |
|---|---|---|---|---|---|---|---|---|
| | | Mean | STD | 95%CL | | | | |
| Jul31/86 | Y | 0.24 | 0.0081 | 0.0101 | 0.23 | 0.15 | 0.1001 | Jul24/86 communication with all of |
| Aug15/86 | Y | 0.28 | 0.0066 | 0.0082 | 0.25 | 0.15 | 0.1382 | trunk 2 lost at 10:08 AM. |
| Aug19/86 | Y | 0.24 | 0.0066 | 0.0082 | 0.23 | 0.15 | 0.0982 | Jul30/86 Trunk 2 still out. |
| Aug21/86 | Y | 0.17 | 0.0081 | 0.0101 | 0.13 | 0.10 | 0.0801 | Jul31/86 Trunk 2 returned to service. |
| Aug25/86 | Y | 0.27 | 0.0104 | 0.0129 | 0.26 | 0.20 | 0.0829 | |
| Aug27/86 | Y | 0.21 | 0.0066 | 0.0082 | 0.21 | 0.10 | 0.1182 | |
| Aug29/86 | Y | 0.11 | 0.0081 | 0.0101 | 0.11 | 0.10 | 0.0201 | |
| Sep02/86 | Y | 0.12 | 0.0081 | 0.0101 | 0.12 | 0.10 | 0.0301 | |
| Sep09/86 | Y | 0.15 | 0.0000 | 0.0000 | 0.14 | 0.10 | 0.0500 | |
| Sep25/86 | Y | 0.18 | 0.0132 | 0.0164 | 0.18 | 0.10 | 0.0964 | |
| Sep30/86 | Y | 0.22 | 0.0081 | 0.0101 | 0.21 | 0.20 | 0.0301 | |
| Oct02/86 | Y | 0.17 | 0.0081 | 0.0101 | 0.18 | 0.10 | 0.0801 | |
| Oct08/86 | Y | 0.17 | 0.0081 | 0.0101 | 0.18 | 0.10 | 0.0801 | |
| Oct27/86 | Y | 0.17 | 0.0081 | 0.0101 | 0.18 | 0.10 | 0.0801 | |
| Nov17/86 | Y | 0.21 | 0.0104 | 0.0129 | 0.21 | 0.15 | 0.0729 | |
| Dec23/86 | Y | 0.18 | 0.0081 | 0.0101 | 0.18 | 0.15 | 0.0401 | Dec22/86 Resistors installed in trunk. |
| Jan08/87 | Y | 0.30 | 0.0132 | 0.0164 | 0.30 | 0.30 | 0.0164 | |
| Jan14/87 | Y | 0.15 | 0.0123 | 0.0153 | 0.15 | 0.10 | 0.0653 | |
| Feb24/87 | Y | 0.29 | 0.0081 | 0.0101 | 0.30 | 0.10 | 0.2001 | |
| Mar16/87 | Y | 0.42 | 0.0081 | 0.0101 | 0.42 | 0.25 | 0.1801 | |
| Mar24/87 | Y | 0.36 | 0.0081 | 0.0101 | 0.36 | 0.20 | 0.1701 | |
| Mar30/87 | Y | 0.34 | 0.0066 | 0.0082 | 0.36 | 0.20 | 0.1482 | |
| Apr22/87 | Y | 0.16 | 0.0168 | 0.0209 | 0.16 | 0.10 | 0.0809 | |

```
              DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA
              ==================================================================

POINT NO: 363            DESCRIPTOR:  9 E Study: Methane 5          INSTRUMENT TYPE:    BM1
=======================================================================================================

                                         PERFORMANCE SUMMARY
               ***************************************************************************
               *                 Average Conspec Reading      Av.       Av.      Max.    *
               * Total           ========================    Local     Tested    Error   *
               * Insp.   Avail.    Mean    STD     95%CL     Value     Value    @ 95%CL  *
               *======================================================================== *
               *    3     100%     0.10   0.0079   0.0098     0.07      0.10    0.0043   *
               ***************************************************************************

=======================================================================================================
                  Conspec Reading                           Max.
             =========================  Local    Tested     Error
  Date      Av  Mean    STD      95%CL    Value    Value    @ 95%CL Comments
=======================================================================================================
 May06/87   Y  0.09   0.0066   0.0082     0.07     0.05    0.0482
 May22/87   Y  0.12   0.0104   0.0129     0.08     0.10    0.0329
 Jun02/87   Y  0.09   0.0066   0.0082     0.05     0.15   -0.0682
```

```
            DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA
            ==================================================================

POINT NO: 364          DESCRIPTOR:  9 E Study: Methane 7          INSTRUMENT TYPE:    BM1
==========================================================================================

                                   PERFORMANCE SUMMARY
          ***********************************************************************
          *                 Average Conspec Reading    Av.       Av.     Max.    *
          * Total           ========================  Local    Tested   Error    *
          * Insp.  Avail.    Mean     STD     95%CL   Value    Value  @ 95%CL    *
          *============================================================         *
          *   3     100%     0.74   0.1547   0.1921    0.74     0.82  -0.2654    *
          ***********************************************************************

==========================================================================================
                Conspec Reading                        Max.
           ========================  Local   Tested    Error
  Date    Av  Mean     STD     95%CL    Value   Value   @ 95%CL Comments
==========================================================================================
 May06/87  Y  0.71   0.0123   0.0153    0.68     0.75  -0.0553
 May22/87  Y  0.62   0.0234   0.0291    0.60     0.70  -0.1091
 Jun02/87  Y  0.90   0.4285   0.5320    0.93     1.00  -0.6320
```

```
                    DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY TREND LOG DATA
                    ==================================================================

POINT NO:  071A            DESCRIPTOR: 9 E Inside Cundy Methane            INSTRUMENT TYPE:     BM1
======================================================================================================

                                     PERFORMANCE SUMMARY
            ##########################################################################
            #                   Average Conspec Reading     Av.       Av.     Max.   #
            # Total            ========================    Local     Tested   Error  #
            # Insp.   Avail.    Mean     STD     95%CL     Value     Value  @ 95%CL  #
            #=========================================================================#
            #   6      100%     0.89   0.0239   0.0297     0.89      0.89   0.0046   #
            ##########################################################################

======================================================================================================
                 Conspec Reading                         Max.
              ========================   Local  Tested   Error
   Date    Av  Mean    STD      95%CL    Value  Value   @ 95%CL Comments
======================================================================================================
Feb06/87   Y  0.92   0.0246   0.0305     0.89    1.10  -0.2105
Feb24/87   Y  1.04   0.0104   0.0129     1.01    0.90   0.1529
Mar16/87   Y  0.85   0.0717   0.0890     0.89    0.85   0.0890
Mar30/87   Y  0.59   0.0066   0.0082     0.62    0.60  -0.0182
May06/87   Y  0.99   0.0168   0.0209     0.99    0.90   0.1109
Jun02/87   Y  0.92   0.0132   0.0164     0.92    1.00  -0.0964
```

# Appendix 3

```
***********************************************
*  OVERALL PERFORMANCE BY BM1 METHANE DETECTORS  *
*             (Immediate Status Data)            *
*===============================================*
*    Total Instruments                       13 *
*    Total Inspections                      117 *
*    Average Error (weighted)           -0.0028 *
*    Availability                           96%*
***********************************************
```

PERFORMANCE SUMMARY BY INSTRUMENT

| Point No. | Descriptor | Total Insp. | Avail. | Mean Conspec Reading | Mean Local Output | Mean Local Diff. | Mean Tested Value | Mean Tested Diff. |
|---|---|---|---|---|---|---|---|---|
| 203/011 | 10 E Top Level | 9 | 89% | 0.70 | 0.69 | -0.00 | 0.69 | 0.04 |
| 200/012 | 10 E Coal Road | 6 | 100% | 0.13 | 0.15 | 0.02 | 0.17 | 0.04 |
| 041 | 6 W Top Level | 14 | 100% | 0.55 | 0.56 | 0.05 | 0.54 | -0.01 |
| 042 | 6 W Coal Road | 10 | 90% | 0.25 | 0.24 | -0.01 | 0.22 | -0.02 |
| 071 | 9 E Top Level | 32 | 100% | 0.33 | 0.34 | 0.01 | 0.32 | 0.02 |
| 072 | 9 E Coal Road | 15 | 100% | 0.11 | 0.11 | 0.01 | 0.11 | 0.01 |
| 012/200 | 8 E Coal Road | 4 | 100% | 0.65 | 0.65 | 0.00 | 0.60 | -0.05 |
| 203 | 8 E Top Level | 3 | 100% | 0.94 | 0.90 | -0.04 | 0.97 | 0.03 |
| 350 | 9 E Study: Methane 1 | 7 | 86% | 0.53 | 0.54 | 0.01 | 0.49 | -0.04 |
| 351 | 9 E Study: Methane 2 | 7 | 86% | 0.58 | 0.46 | -0.11 | 0.46 | -0.11 |
| 352 | 9 E Study: Methane 3 | 7 | 86% | 0.45 | 0.48 | 0.03 | 0.43 | -0.01 |
| 355 | 9 E Study: Methane 6 | 2 | 100% | 0.19 | 0.18 | -0.00 | 0.13 | -0.06 |
| 71A | 9 E Inside Cundy | 1 | 100% | 1.04 | 1.00 | -0.04 | 1.00 | -0.04 |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS

POINT NO: 203/011 DESCRIPTOR: 10 E Top Level Methane INSTRUMENT TYPE: BM1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Mean Conspec Reading | Mean Local Output | Mean Local Diff. | Mean Tested Value | Mean Tested Diff. |
|---|---|---|---|---|---|---|
| 9 | 89% | 0.70 | 0.69 | -0.00 | 0.69 | 0.03 |

| Date | Av | Conspec Output | Local Output (BM1) | Local Diff. (BM1) | Tested Output (D6) | Tested Diff. (D6) | Comments |
|---|---|---|---|---|---|---|---|
| Aug12/86 | Y | 0.68 | 0.68 | 0.00 | 0.75 | 0.07 | |
| Sep10/86 | Y | 0.96 | 0.98 | 0.02 | | | Sep10/86 Dead D6 battery. |
| Oct07/86 | Y | 0.63 | 0.63 | 0.00 | 0.65 | 0.02 | |
| Oct09/86 | Y | 0.82 | 0.81 | -0.01 | 0.90 | 0.08 | |
| Oct15/86 | Y | 0.66 | 0.66 | 0.00 | 0.70 | 0.04 | Oct24/86 New point no.; 011 (was 203). |
| Oct27/86 | Y | 0.54 | 0.56 | 0.02 | 0.60 | 0.06 | |
| Nov18/86 | Y | 0.59 | 0.60 | 0.01 | 0.65 | 0.06 | |
| Nov25/86 | Y | 0.75 | 0.70 | -0.05 | 0.70 | -0.05 | |
| Dec01/86 | N | | 0.59 | | 0.55 | | Dec01/86 Point in comm. failure. |

```
              DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS
              ====================================================================

POINT NO:  200/012          DESCRIPTOR:  10 E Coal Road Methane     INSTRUMENT TYPE:     BM1
==============================================================================================

                                   PERFORMANCE SUMMARY
              ###################################################################
              #                   Mean      Mean     Mean       Mean     Mean    #
              #  Total            Conspec   Local    Local      Tested   Tested  #
              #  Insp.    Avail.  Reading   Output   Diff.      Value    Diff.   #
              #=============================================================== #
              #      6     100%    0.13      0.15     0.02       0.17     0.04   #
              ###################################################################

==============================================================================================
                         Local     Local     Tested    Tested
                Conspec  Output    Diff.     Output    Diff.
  Date     Av   Output   (BM1)     (BM1)     (D6)      (D6)     Comments
==============================================================================================
 Aug12/86   Y    0.15     0.17      0.02      0.20      0.05
 Sep10/86   Y    0.13     0.16      0.03
 Oct07/86   Y    0.10     0.11      0.01      0.15      0.05
 Oct09/86   Y    0.12     0.14      0.02      0.20      0.08
 Oct15/86   Y    0.18     0.20      0.02      0.22      0.04    Oct24/86 New point no.; 012 (was 202).
 Dec01/86   Y    0.10     0.12      0.02      0.08     -0.02
```

## DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS

POINT NO: 041 DESCRIPTOR: 6 W Top Level Methane INSTRUMENT TYPE: BM1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Mean Conspec Reading | Mean Local Output | Mean Local Diff. | Mean Tested Value | Mean Tested Diff. |
|---|---|---|---|---|---|---|
| 14 | 100% | 0.55 | 0.56 | 0.05 | 0.54 | -0.01 |

| Date | Av | Conspec Output | Local Output (BM1) | Local Diff. (BM1) | Tested Output (D6) | Tested Diff. (D6) | Comments |
|---|---|---|---|---|---|---|---|
| Aug12/86 | Y | 0.44 | 0.46 | 0.02 | 0.50 | 0.06 | |
| Sep10/86 | Y | 0.49 | 0.51 | 0.02 | | | |
| Oct07/86 | Y | 0.49 | 0.59 | 0.10 | 0.45 | -0.04 | |
| Oct09/86 | Y | 0.47 | 0.50 | 0.50 | 0.50 | 0.03 | |
| Oct15/86 | Y | 0.52 | 0.53 | 0.01 | 0.55 | 0.03 | |
| Oct21/86 | Y | 0.43 | 0.42 | -0.01 | 0.40 | -0.03 | |
| Oct27/86 | Y | 0.35 | 0.38 | 0.03 | 0.40 | 0.05 | |
| Nov18/86 | Y | 0.99 | 0.91 | -0.08 | 1.10 | 0.11 | |
| Nov24/86 | Y | 0.47 | 0.50 | 0.03 | 0.45 | -0.02 | |
| Dec01/86 | Y | 0.74 | 0.80 | 0.06 | 0.50 | -0.24 | |
| Dec09/86 | Y | 0.46 | 0.45 | -0.01 | 0.40 | -0.06 | |
| Dec15/86 | Y | 0.50 | 0.50 | 0.00 | 0.50 | 0.00 | |
| Jan28/87 | Y | 0.62 | 0.60 | -0.02 | 0.60 | -0.02 | |
| Feb10/87 | Y | 0.69 | 0.71 | 0.02 | 0.70 | 0.01 | |

## DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS

POINT NO: 242 DESCRIPTOR: 6 W Coal Road Methane INSTRUMENT TYPE: BM1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Mean Conspec Reading | Mean Local Output | Mean Local Diff. | Mean Tested Value | Mean Tested Diff. |
|---|---|---|---|---|---|---|
| 10 | 90% | 0.25 | 0.24 | -0.01 | 0.22 | -0.02 |

| Date | Av | Conspec Output | Local Output (BM1) | Local Diff. (BM1) | Tested Output (D6) | Tested Diff. (D6) | Comments |
|---|---|---|---|---|---|---|---|
| Oct07/86 | Y | 0.21 | 0.20 | -0.01 | 0.20 | -0.01 | |
| Oct09/86 | Y | 0.22 | 0.22 | 0.00 | 0.20 | -0.02 | |
| Oct15/86 | Y | 0.28 | 0.29 | 0.01 | 0.25 | -0.03 | |
| Oct21/86 | Y | 0.27 | 0.28 | 0.01 | 0.20 | -0.07 | |
| Dec01/86 | Y | 0.21 | 0.20 | -0.01 | 0.20 | -0.01 | |
| Dec09/86 | Y | 0.18 | 0.15 | -0.03 | 0.20 | 0.02 | |
| Dec15/86 | Y | 0.24 | 0.20 | -0.04 | 0.20 | -0.04 | |
| Jan20/87 | N | | 0.20 | | 0.20 | | |
| Jan28/87 | Y | 0.28 | 0.26 | -0.02 | 0.25 | -0.03 | |
| Feb10/87 | Y | 0.35 | 0.37 | 0.02 | 0.30 | -0.05 | |

# DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS

POINT NO: 071 DESCRIPTOR: 9 E Top Level Methane INSTRUMENT TYPE: BM1

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Mean Conspec Reading | Mean Local Output | Mean Local Diff. | Mean Tested Value | Mean Tested Diff. |
|---|---|---|---|---|---|---|
| 32 | 100% | 0.33 | 0.34 | 0.01 | 0.32 | 0.02 |

| Date | Av | Conspec Output | Local Output (BM1) | Local Diff. (BM1) | Tested Output (D6) | Tested Diff. (D6) | Comments |
|---|---|---|---|---|---|---|---|
| Jul15/86 | Y | 0.78 | 0.80 | 0.02 | 0.70 | -0.08 | |
| Jul21/86 | Y | 0.91 | 0.90 | -0.01 | | | |
| Jul24/86 | Y | 0.80 | 0.80 | 0.00 | 0.70 | -0.10 | |
| Jul31/86 | Y | 0.76 | 0.77 | 0.01 | 0.65 | -0.11 | |
| Aug06/86 | Y | 0.56 | 0.57 | 0.01 | 0.40 | -0.16 | |
| Aug11/86 | Y | 0.53 | 0.54 | 0.01 | 0.50 | -0.03 | |
| Aug15/86 | Y | 0.73 | 0.79 | 0.06 | 0.75 | 0.02 | |
| Aug19/86 | Y | 0.67 | 0.70 | 0.03 | 0.60 | -0.07 | |
| Aug21/86 | Y | 0.53 | 0.58 | 0.05 | 0.70 | 0.17 | |
| Aug25/86 | Y | 0.50 | 0.51 | 0.01 | 0.70 | 0.20 | |
| Aug27/86 | Y | 0.44 | 0.46 | 0.02 | 0.60 | 0.16 | |
| Sep02/86 | Y | 0.46 | 0.46 | 0.00 | 0.55 | 0.09 | |
| Sep09/86 | Y | 0.56 | 0.59 | 0.03 | 0.65 | 0.09 | Sep20/86 Wall on cundy ventil- |
| Sep17/86 | Y | 0.66 | 0.67 | 0.01 | 0.75 | 0.09 | ation, ie point is now in intake |
| Sep22/86 | Y | 0.10 | 0.12 | 0.02 | 0.05 | -0.05 | air. |
| Sep22/86 | Y | 0.04 | 0.05 | 0.01 | 0.05 | 0.01 | Sep22/86 Point tested before |
| Sep25/86 | Y | 0.06 | 0.06 | 0.00 | 0.10 | 0.04 | and after sensor change. |
| Sep30/86 | Y | 0.10 | 0.10 | 0.00 | 0.15 | 0.05 | |
| Oct02/86 | Y | 0.04 | 0.06 | 0.02 | 0.10 | 0.06 | |
| Oct06/86 | Y | 0.07 | 0.07 | 0.00 | 0.10 | 0.03 | |
| Oct08/86 | Y | 0.04 | 0.06 | 0.02 | 0.05 | 0.01 | |
| Oct15/86 | Y | 0.15 | 0.18 | 0.03 | 0.20 | 0.05 | |
| Oct16/86 | Y | 0.06 | 0.09 | 0.03 | 0.10 | 0.04 | |
| Oct20/86 | Y | 0.06 | 0.07 | 0.01 | 0.10 | 0.04 | |
| Oct23/86 | Y | 0.09 | 0.10 | 0.01 | 0.10 | 0.01 | |
| Nov14/86 | Y | 0.10 | 0.10 | 0.00 | 0.10 | 0.00 | |
| Nov17/86 | Y | 0.12 | 0.10 | -0.02 | 0.10 | -0.02 | |
| Nov24/86 | Y | 0.10 | 0.06 | -0.04 | 0.10 | 0.00 | |
| Nov28/86 | Y | 0.11 | 0.10 | -0.01 | 0.10 | -0.01 | |
| Dec02/86 | Y | 0.09 | 0.05 | -0.04 | 0.00 | -0.09 | |
| Dec15/86 | Y | 0.18 | 0.16 | -0.02 | 0.15 | -0.03 | |
| Dec23/86 | Y | 0.09 | 0.09 | 0.00 | 0.15 | 0.06 | |

## DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS

POINT NO: 072 DESCRIPTOR: 9 E Coal Road Methane INSTRUMENT TYPE: BM1

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Mean Conspec Reading | Mean Local Output | Mean Local Diff. | Mean Tested Value | Mean Tested Diff. |
|---|---|---|---|---|---|---|
| 15 | 100% | 0.11 | 0.11 | 0.01 | 0.11 | 0.01 |

| Date | Av | Conspec Output | Local Output (BM1) | Local Diff. (BM1) | Tested Output (D6) | Tested Diff. (D6) | Comments |
|---|---|---|---|---|---|---|---|
| Aug15/86 | Y | 0.15 | 0.17 | 0.02 | 0.15 | 0.00 | |
| Aug19/86 | Y | 0.16 | 0.14 | -0.02 | 0.15 | -0.01 | |
| Aug21/86 | Y | 0.12 | 0.12 | 0.00 | 0.10 | -0.02 | |
| Aug25/86 | Y | 0.19 | | | | | Aug25/86 Local and Tested not checked. |
| Aug27/86 | Y | 0.12 | 0.12 | 0.00 | 0.10 | -0.02 | |
| Sep02/86 | Y | 0.09 | 0.07 | -0.02 | 0.10 | 0.01 | |
| Sep09/86 | Y | 0.04 | 0.06 | 0.02 | 0.05 | 0.01 | |
| Sep30/86 | Y | 0.06 | 0.09 | 0.03 | 0.15 | 0.09 | |
| Oct02/86 | Y | 0.07 | 0.12 | 0.03 | 0.10 | 0.03 | |
| Oct06/86 | Y | 0.09 | 0.10 | 0.01 | 0.10 | 0.01 | |
| Oct08/86 | Y | 0.04 | 0.06 | 0.02 | 0.15 | 0.11 | |
| Oct20/86 | Y | 0.10 | 0.12 | 0.02 | 0.10 | 0.00 | |
| Nov17/86 | Y | 0.10 | 0.10 | 0.00 | 0.10 | 0.00 | |
| Dec02/86 | Y | 0.15 | 0.18 | 0.03 | 0.05 | -0.10 | |
| Dec23/86 | Y | 0.15 | 0.17 | 0.02 | 0.15 | 0.00 | |

```
          DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS
          ====================================================================

POINT NO:  012/200          DESCRIPTOR:  8 E Coal Road Methane       INSTRUMENT TYPE:      BM1
==================================================================================================

                                       PERFORMANCE SUMMARY
                 *********************************************************************
                 *                      Mean      Mean      Mean       Mean      Mean     *
                 *  Total               Conspec   Local     Local      Tested    Tested   *
                 *  Insp.     Avail.    Reading   Output    Diff.      Value     Diff.    *
                 *================================================================    *
                 *       4      100%     0.65      0.65      0.00       0.60     -0.05    *
                 *********************************************************************

==================================================================================================
                            Local     Local     Tested    Tested
                 Conspec    Output    Diff.     Output    Diff.
   Date     Av   Output     (BM1)     (BM1)     (D6)      (D6)     Comments
==================================================================================================
 Aug14/86   Y     0.15      0.14     -0.01      0.10     -0.05   Sep20-21/86 Wall is now cundy return
 Dec01/86   Y     0.74      0.72     -0.02      0.60     -0.14    for 9 East.
 Dec15/86   Y     0.85      0.85      0.00      0.70     -0.15   Oct24/86 New point no.; 200
 Feb10/87   Y     0.86      0.89      0.03      1.00      0.14    was (012).
```

```
                  DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS
                  ====================================================================

POINT NO: 203             DESCRIPTOR:  8 E Top Level Methane      INSTRUMENT TYPE:      BM1
=================================================================================================

                                      PERFORMANCE SUMMARY
             *********************************************************************
             *                      Mean      Mean      Mean        Mean     Mean      *
             *  Total               Conspec   Local     Local       Tested   Tested    *
             *  Insp.      Avail.   Reading   Output    Diff.       Value    Diff.     *
             *================================================================     *
             *      3       100%    0.94      0.90      -0.04       0.97     0.03      *
             *********************************************************************

=================================================================================================
                            Local     Local     Tested    Tested
                  Conspec   Output    Diff.     Output    Diff.
   Date      Av   Output    (BM1)     (BM1)     (D6)      (D6)      Comments
=================================================================================================
 Dec01/86    Y     0.79      0.79      0.00      0.75     -0.04
 Dec15/86    Y     0.87      0.80     -0.07      0.90      0.03
 Feb10/87    Y     1.16      1.12     -0.04      1.25      0.09
```

```
             DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS
             ====================================================================

POINT NO: 350              DESCRIPTOR:  9 E Study: Methane 1       INSTRUMENT TYPE:     BM1
============================================================================================

                                   PERFORMANCE SUMMARY
             ******************************************************************
             *                   Mean      Mean     Mean      Mean      Mean   *
             *  Total            Conspec   Local    Local     Tested    Tested *
             *  Insp.   Avail.   Reading   Output   Diff.     Value     Diff.  *
             *============================================================   *
             *      7     86%    0.53      0.54     0.01      0.49      -0.04  *
             ******************************************************************

============================================================================================
                            Local     Local    Tested   Tested
                   Conspec  Output    Diff.    Output   Diff.
   Date     A      Output   (BM1)     (BM1)    (D6)     (D6)    Comments
============================================================================================
 Jul07/86   Y      0.78     0.77      -0.01    0.75     -0.03
 Jul24/86   Y      0.96     1.05       0.09    1.00      0.04   Jul24/86 communication with all of
 Jul30/86   N                                                     trunk 2 lost at 10:08 AM.
 Aug06/86   Y      0.59     0.58      -0.01    0.50     -0.09   Jul30/86 Trunk 2 still out.
 Aug11/86   Y      0.54     0.55       0.01    0.55      0.01   Jul31/86 Trunk 2 returned to service.
 Nov28/86   Y      0.19     0.16      -0.03    0.10     -0.09
 Dec22/86   Y      0.12     0.10      -0.02    0.05     -0.07
```

```
          DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS
          ====================================================================

POINT NO: 351             DESCRIPTOR:  9 E Study: Methane 2       INSTRUMENT TYPE:     BM1
===============================================================================================

                                   PERFORMANCE SUMMARY
             ********************************************************************
             *                      Mean     Mean     Mean        Mean     Mean    *
             *  Total               Conspec  Local    Local       Tested   Tested  *
             *  Insp.      Avail.   Reading  Output   Diff.       Value    Diff.   *
             *=================================================================  *
             *        7       86%   0.58     0.46     -0.11       0.46     -0.11   *
             ********************************************************************

===============================================================================================
                           Local    Local     Tested   Tested
                Conspec    Output   Diff.     Output   Diff.
  Date     Av   Output     (BM1)    (BM1)     (D6)     (D6)     Comments
===============================================================================================
 Jul07/86   Y     0.68      0.67    -0.01      0.65    -0.03
 Jul24/86   Y     0.85      0.97     0.12      1.00     0.15
 Jul30/86   N                                                  Jul24/86 communication with all of
 Aug06/86   Y     0.76      0.45    -0.31      0.50    -0.26    trunk 2 lost at 10:08 AM.
 Aug11/86   Y     0.81      0.43    -0.38      0.36    -0.43   Jul30/86 Trunk 2 still out.
 Nov28/86   Y     0.24      0.17    -0.07      0.15    -0.09   Jul31/86 Trunk 2 returned to service.
 Dec22/86         0.12      0.09    -0.03      0.12    -0.00
```

```
                 DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS
                 ====================================================================

POINT NO: 352                DESCRIPTOR:  9 E Study: Methane 3        INSTRUMENT TYPE:     BM1
==============================================================================================

                                     PERFORMANCE SUMMARY
           ******************************************************************
           *                    Mean      Mean      Mean        Mean      Mean     *
           *  Total             Conspec   Local     Local       Tested    Tested   *
           *  Insp.     Avail.  Reading   Output    Diff.       Value     Diff.    *
           *================================================================       *
           *      7       86%    0.45      0.48      0.03        0.43     -0.01    *
           ******************************************************************

==============================================================================================
                           Local     Local     Tested    Tested
                  Conspec  Output    Diff.     Output    Diff.
   Date      Av   Output   (BM1)     (BM1)     (D6)      (D6)     Comments
==============================================================================================
 Jul07/86    Y     0.59     0.59      0.00      0.55     -0.04
 Jul24/86    Y     0.71     0.83      0.12      0.80      0.09   Jul24/86 communication with all of
 Jul30/86    N                                                     trunk 2 lost at 10:08 AM.
 Aug06/86    Y     0.38     0.50      0.12      0.35     -0.03   Jul30/86 Trunk 2 still out.
 Aug11/86    Y     0.38     0.37     -0.01      0.35     -0.03   Jul31/86 Trunk 2 returned to service.
 Nov28/86    Y     0.34     0.32     -0.02      0.30     -0.04
 Dec22/86    Y     0.27     0.27      0.00      0.25     -0.02
```

```
              DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS
              ====================================================================

POINT NO: 355               DESCRIPTOR:  9 E Study: Methane 6       INSTRUMENT TYPE:    BM1
==============================================================================================

                                     PERFORMANCE SUMMARY
            ******************************************************************
            *                    Mean     Mean     Mean       Mean     Mean   *
            *  Total             Conspec  Local    Local      Tested   Tested *
            *  Insp.     Avail.  Reading  Output   Diff.      Value    Diff.  *
            *============================================================== *
            *      2      100%   0.19     0.18     -0.00      0.13     -0.06  *
            ******************************************************************

==============================================================================================
                         Local    Local    Tested   Tested
                Conspec  Output   Diff.    Output   Diff.
  Date     Av   Output   (BM1)    (BM1)    (D6)     (D6)     Comments
==============================================================================================
Aug11/86   Y     0.24    0.23     -0.01    0.15     -0.09
Dec02/86   Y     0.13    0.13      0.00    0.10     -0.03
```

```
                 DAILY INSPECTION OF METHANE IN AIR SENSORS (BM1) BY IMMEDIATE STATUS
                 ====================================================================

POINT NO: 071A          DESCRIPTOR:  9 E Inside Cundy Methane   INSTRUMENT TYPE:    BM1
==========================================================================================

                                   PERFORMANCE SUMMARY
              *******************************************************************
              *                 Mean     Mean     Mean       Mean     Mean     *
              *  Total          Conspec  Local    Local      Tested   Tested   *
              *  Insp.   Avail. Reading  Output   Diff.      Value    Diff.    *
              ================================================================ *
              *      1    100%   1.04     1.00    -0.04       1.00    -0.04    *
              *******************************************************************

==========================================================================================
                        Local    Local    Tested   Tested
               Conspec  Output   Diff.    Output   Diff.
  Date     Av  Output   (BM1)    (BM1)    (D6)     (D6)    Comments
==========================================================================================
Feb13/87   Y    1.04    1.00    -0.04     1.00    -0.04
```

# Appendix 4

```
*************************************************************
* OVERALL PERFORMANCE BY JTEC METHANE DRAINAGE FLOW DETECTORS *
*                      (Trend Log Data)                     *
*===========================================================*
* Total Instruments                                       3 *
* Total Inspections                                      36 *
* Average Error (95% CL) (weighted)                   30.77 *
* Availability                                         100% *
*************************************************************



                        PERFORMANCE SUMMARY BY INSTRUMENT
===============================================================================================
                                                    Average Conspec Reading       Av.    Max.
 Point                           Total              ===========================  Tested  Error
  No.   Descriptor               Insp.     Avail.    Mean      STD      95%CL     Value  @95%CL
===============================================================================================

201/014  10 E Methane Drainage     12       100%  840.42    19.54     24.26       693   162.23

044      6 W Methane Drainage      14       100%  334.04    11.23     13.94       569  -250.62

074      9 E Methane Drainage      10       100%  859.24    41.65     51.71       648   266.96
```

# DAILY INSPECTION OF METHANE FLOW (PIPE JTEC) BY TREND LOG

POINT NO: 201/014 DESCRIPTOR: 10 E Drainage Flow INSTRUMENT TYPE: Pipe Jtec

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Tested Value | Max. Error @95%CL |
|---|---|---|---|---|---|---|
| 12 | 100% | 840.42 | 19.54 | 24.26 | 693 | 162.23 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Tested Value | Max. Error @95%CL | Comments |
|---|---|---|---|---|---|---|---|
| Oct07/86 | Y | 970.53 | 17.65 | 21.91 | 608 | 384.44 | |
| Oct09/86 | Y | 989.57 | 31.93 | 39.64 | 608 | 421.21 | |
| Oct15/86 | Y | 896.75 | 22.26 | 27.64 | 634 | 290.39 | |
| Oct21/86 | Y | 1156.17 | 35.10 | 43.58 | 678 | 521.75 | Oct24/86 New point no. 014 (was 201). |
| Oct27/86 | Y | 1122.85 | 14.58 | 18.10 | 560 | 580.95 | Oct28/86 Calibrated from 1200 to 600 |
| Dec09/86 | Y | 656.33 | 10.00 | 12.42 | 658 | -14.09 | by R. MacNeil. |
| Dec16/86 | Y | 646.85 | 11.90 | 14.77 | 667 | -34.92 | |
| Jan28/87 | Y | 432.65 | 8.41 | 10.44 | 683 | -260.79 | |
| Feb10/87 | Y | 839.63 | 13.04 | 16.19 | 725 | 130.82 | |
| Feb20/87 | Y | 834.87 | 22.89 | 28.42 | 809 | 54.29 | |
| Mar09/87 | Y | 727.77 | 19.55 | 24.27 | 993 | -289.50 | |
| May22/87 | Y | 811.07 | 27.14 | 33.69 | | | May22/87 No test data for this week. |

```
               DAILY INSPECTION OF METHANE FLOW (PIPE JTEC) BY TREND LOG
               =========================================================

POINT NO: 044              DESCRIPTOR:  6 W Drainage Flow        INSTRUMENT TYPE:  Pipe Jtec
============================================================================================

                                  PERFORMANCE SUMMARY
           ######################################################################
           *                        Average Conspec Reading       Av.   Max.      *
           *  Total                 =======================      Tested Error     *
           *  Insp.     Avail.     Mean      STD      95%CL      Value  @95%CL    *
           *====================================================================*
           *     14      100%  334.04    11.23     13.94        569  -250.62     *
           ######################################################################

============================================================================================
                 Conspec Reading                 Max.
         ==========================   Tested   Error
  Date     Av    Mean      STD     95%CL    Value   @95%CL Comments
============================================================================================
 Jul14/86   Y   351.73    9.96    12.37      567  -227.64
 Jul28/86   Y   332.69    6.52     8.09                    Jul28/86 No test data available.
 Aug18/86   Y   358.87    9.96    12.37                    Aug18/86 No test data available.
 Aug28/86   Y   346.97    5.32     6.60      255    98.57
 Sep16/86   Y   327.93    9.96    12.37      608  -292.44
 Sep19/86   Y   366.01   10.64    13.21      608  -255.20
 Sep23/86   Y   356.41   18.15    22.53      608  -274.12
 Oct01/86   Y   373.15   11.19    13.89      588  -228.74
 Oct07/86   Y   327.93    9.96    12.37      568  -252.44
 Oct09/86   Y   344.59   15.97    19.83      568  -243.24
 Oct15/86   Y   306.51   13.57    16.85      596  -306.34
 Oct21/86   Y   308.89    6.52     8.09      550  -249.20
 Oct27/86   Y   299.37    9.96    12.37      479  -192.00
 Mar17/87   Y   275.57   19.55    24.27      836  -584.70
```

```
            DAILY INSPECTION OF METHANE FLOW (PIPE JTEC) BY TREND LOG
            =========================================================

POINT NO:  074          DESCRIPTOR:  9 E Drainage Flow       INSTRUMENT TYPE:  Pipe Jtec
==================================================================================

                              PERFORMANCE SUMMARY
       ***************************************************************
       *                      Average Conspec Reading     Av.    Max.     *
       *  Total               =======================     Tested Error    *
       *  Insp.     Avail.    Mean     STD      95%CL     Value  @95%CL   *
       *=============================================================*
       *     10      100%    859.24   41.65     51.71       648   266.96   *
       ***************************************************************

==================================================================================
                Conspec Reading                  Max.
           ===========================  Tested  Error
  Date    Av    Mean       STD     95%CL    Value  @95%CL Comments
==================================================================================
 Jun12/86  Y   882.47     13.04    16.19     590   308.66
 Jun18/86  Y   837.00     18.80    23.34     610   250.34
 Jul07/86  Y   865.80     10.60    13.16     675   203.96
 Jul15/86  Y   846.77     22.89    28.42     621   254.19
 Jul30/86  Y   901.51     18.05    22.41                  Jul30/86 No test data available.
 Feb06/87  Y   746.81     80.97   100.52
 Feb18/87  Y   894.37     15.51    19.26
 Mar02/87  Y   861.05    159.95   198.58     742   317.63
 May06/87  Y   914.60     39.47    49.00
 Jun03/87  Y   842.01     37.25    46.25
```

# Appendix 5

```
*************************************************************
*  OVERALL PERFORMANCE OF JTEC METHANE DRAINAGE FLOW DETECTORS  *
*                  (Immediate Status Data)                     *
*===========================================================*
*  Total Instruments                                      3  *
*  Total Inspections                                     47  *
*  Average Error (weighted)                          -92.27  *
*  Availability                                         79% *
*************************************************************
```

```
                              PERFORMANCE SUMMARY BY INSTRUMENT
================================================================================================
                                                      Av.      Av.
 Point                          Total               Conspec  Tested     Av.
  No.    Descriptor             Insp.      Avail.   Output   Value     Error
================================================================================================
201/014   10 E Drainage Flow      3         100%   638.67      692     53.67

044       6 W Drainage Flow      13          31%   364.21      547    131.60

074       9 E Drainage Flow      31          97%   814.03      677   -136.71
```

```
            DAILY INSPECTION OF METHANE GAS FLOW SENSORS (PIPE JTEC) BY IMMEDIATE STATUS
            ============================================================================

POINT NO:  201/014          DESCRIPTOR:  10 E Drainage Flow           INSTRUMENT TYPE:  Pipe Jtec
=========================================================================================================

                                                  PERFORMANCE SUMMARY
                                       **************************************************
                                       *                          Av.       Av.               *
                                       *    Total                Consp.    Tested    Ave.     *
                                       *    Insp.       Avail.  Output    Value     Error     *
                                       *================================================*
                                       *      3          100%   638.67     692      53.67     *
                                       **************************************************

=========================================================================================================


                  Conspec    Tested     Ave.
   Date     Av    Output     Value      Error   Comments
=========================================================================================================
 Nov18/86    Y    694.45      697        2.55   Oct24/87 New point no. 014 (was 201).
 Nov25/86    Y    539.00      716      177.00
 Dec01/86    Y    682.55      664      -18.55
```

## DAILY INSPECTION OF METHANE GAS FLOW SENSORS (PIPE JTEC) BY IMMEDIATE STATUS

POINT NO: 044 DESCRIPTOR: 6 W Drainage Flow INSTRUMENT TYPE: Pipe Jtec

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Av. Consp. Output | Av. Tested Value | Ave. Error |
|---|---|---|---|---|
| 13 | 31% | 364.21 | 547 | 131.60 |

| Date | Av | Conspec Output | Tested Value | Ave. Error | Comments |
|---|---|---|---|---|---|
| Jul18/86 | N | | | | Jul18/86 Instrument in comm. failure. |
| Aug12/86 | Y | 313.65 | | | |
| Sep10/86 | Y | 361.25 | 590 | 228.75 | |
| Nov18/86 | N | | 655 | | Nov18/86 Instrument in comm. fail: water in line. |
| Dec01/86 | N | | 570 | | Dec01/86 Instrument in comm. fail: water in line. |
| Dec15/86 | N | | 517 | | Dec15/86 Instrument in comm. fail: water in line. |
| Jan20/86 | N | | | | Jan20/87 Instrument in comm. fail: water in line. |
| Jan28/86 | Y | 515.95 | 459 | -56.95 | |
| Feb03/87 | N | | | 0.00 | Feb03/87 Instrument in comm. failure. |
| Feb12/87 | Y | 266.00 | 489 | 223.00 | |
| Mar03/87 | N | | | 0.00 | Mar03/87 Instrument in comm. failure. |
| Mar09/87 | N | | | 0.00 | Mar09/87 Instrument in comm. failure. |
| May19/87 | N | | | 0.00 | May19/87 Instrument in comm. failure. |

```
       DAILY INSPECTION OF METHANE GAS FLOW SENSORS (PIPE JTEC) BY IMMEDIATE STATUS
       ============================================================================

POINT NO: 074              DESCRIPTOR:  9 E Drainage Flow           INSTRUMENT TYPE:  Pipe Jtec
=============================================================================================

                                    PERFORMANCE SUMMARY
                       ************************************************
                       *                         Av.     Av.           *
                       *    Total               Consp.  Tested   Ave.  *
                       *    Insp.       Avail.  Output  Value    Error *
                       *==============================================*
                       *     31           97%   814.03    677  -136.71 *
                       ************************************************

=============================================================================================

                  Conspec   Tested    Ave.
    Date     Av   Output    Value    Error    Comments
=============================================================================================
   Jul21/86   Y   652.00                      Not tested during vacation.
   Jul24/86   Y   789.00                          "    "    "    "
   Jul31/86   Y   896.75                          "    "    "    "
   Aug06/86   Y   887.25                          "    "    "    "
   Aug11/86   Y   587.00     644     57.00
   Aug15/86   Y   849.15     644   -205.15
   Aug17/86   Y   896.75     664   -232.75
   Aug21/86   Y   694.45     635    -59.45
   Aug25/86   Y   765.85     635   -130.85
   Aug27/86   Y   694.45     635    -59.45
   Sep02/86   Y   672.65     612    -60.65
   Sep09/86   Y   682.00     709     27.00
   Sep17/86   Y   825.35     745    -80.35
   Sep22/86   Y   813.45     666   -147.45
   Sep25/86   Y   742.25     666    -76.25
   Sep30/86   Y   745.85     666    -79.85
   Oct02/86   Y   718.25     686    -32.25
   [illegible]    765.85     671    -94.85
   [illegible]    825.35     671   -154.35
   Oct15/86   Y   801.55     614   -187.55
   Oct16/86   Y   872.95     614   -258.95
   Oct20/86   Y   765.85     706    -59.85
   Oct23/86   Y   825.35     706   -119.35
   Nov14/86   Y   956.25     712   -244.25
   Nov17/86   Y   861.00     691   -170.00
   Nov24/86   N                               Nov24/86 Water in pipe line may
   Nov28/86   Y   801.00     713    -88.00     be causing errors in Conspec output.
   Dec02/86   Y   777.84     629   -148.84
   Dec15/86   Y   884.85     605   -279.85
   Dec23/86   Y   861.05                      Dec23/86 No testing during vacation.
   Feb13/87   Y  1491.75     960   -531.75
```

# Appendix 6

```
*************************************************
*   OVERALL PERFORMANCE OF BM2H METHANE SENSORS  *
*              (Trend Log Data)                  *
*===============================================*
*   Total Instruments                          4 *
*   Total Inspections                         44 *
*   Average Error (95% CL) (weighted)      10.41 *
*   Availability                             98%*
*************************************************
```

```
                                  PERFORMANCE SUMMARY BY INSTRUMENT
==========================================================================================
                                                      Average Conspec Reading      Av.     Max.
 Point                             Total              ========================    Local    Error
  No.    Descriptor                Insp.     Avail.    Mean     STD      95%CL    Value   @95%CL
==========================================================================================
202/013  10 E Drainage CH4           11       100%    67.66   0.4473   0.5553      55     13.49

043       6 W Drainage CH4           17       100%    53.29   0.5335   0.6623      43     10.09

073       9 E Drainage CH4           10        90%    67.06   0.4466   0.5544      59      8.17

300       EXT. PT. Inlet CH4          6       100%    60.59   0.3075   0.3818      54      6.81
```

```
              DAILY INSPECTION OF METHANE DRAINAGE GAS (BM2H) BY TREND LOG DATA
              =================================================================

POINT NO:  202/013          DESCRIPTOR:  10 E Drainage CH4          INSTRUMENT TYPE:    BM2H
=================================================================================================

                                    PERFORMANCE SUMMARY
              ***********************************************************************
              *                     Average Conspec Reading      Av.    Max.       *
              *  Total              ========================     Local  Error      *
              *  Insp.    Avail.    Mean     STD      95%CL      Value  @95%CL     *
              *=====================================================================*
              *    11      100%    67.66   0.4473   0.5553        55    13.49      *
              ***********************************************************************

=================================================================================================
                   Conspec Reading                     Max.
             ============================     Local   Error
  Date    Av     Mean      STD      95%CL      Value  @95%CL Comments
=================================================================================================
 Oct07/86  Y    71.93    0.2191    0.2720       43    29.20
 Oct09/86  Y    74.19    0.4383    0.5441       45    29.73
 Oct15/86  Y    48.80    0.2684    0.3332       25    24.13
 Oct21/86  Y    61.25    0.4000    0.4966       53     8.75  Oct17/86 Control unit and sensor
 Dec09/86  Y    70.07    0.6001    0.7450       64     6.82   changed out.
 Dec16/86  Y    69.68    0.2191    0.2720       64     5.95  Oct24/87 New point no. 013 (was 202).
 Jan28/87  Y    76.44    0.3464    0.4301       68     8.87
 Feb10/87  Y    71.74    0.2684    0.3332       64     8.07
 Feb20/87  Y    60.96    1.0161    1.2615       52    10.22
 Mar09/87  Y    64.10    0.7342    0.9115       56     9.01
 May22/87  Y    75.07    0.4100    0.5090       68     7.58
```

# DAILY INSPECTION OF METHANE DRAINAGE GAS (BM2H) BY TREND LOG DATA

POINT NO: 43 DESCRIPTOR: 6 W Drainage CH4 INSTRUMENT TYPE: BM2H

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | Average Conspec Reading STD | Average Conspec Reading 95%CL | Av. Local Value | Max. Error @95%CL |
|---|---|---|---|---|---|---|
| 17 | 100% | 53.29 | 0.5335 | 0.6623 | 43 | 10.89 |

| Date | Av | Conspec Reading Mean | Conspec Reading STD | Conspec Reading 95%CL | Local Value | Max. Error @95%CL | Comments |
|---|---|---|---|---|---|---|---|
| Jun17/86 | Y | 71.54 | 0.7752 | 0.9624 | 60 | 12.50 | |
| Jul14/86 | Y | 51.84 | 0.5400 | 0.6704 | 41 | 11.51 | |
| Jul18/86 | Y | 54.98 | 0.7300 | 0.9063 | 44 | 11.89 | |
| Jul28/86 | Y | 46.60 | 0.4900 | 0.6083 | 37 | 10.21 | |
| Aug18/86 | Y | 43.32 | 0.2684 | 0.3332 | 32 | 11.65 | |
| Aug28/86 | Y | 47.63 | 0.2191 | 0.2720 | 38 | 9.90 | |
| Sep16/86 | Y | 50.86 | 0.7268 | 0.9023 | 41 | 10.76 | |
| Sep19/86 | Y | 57.13 | 0.2684 | 0.3332 | 47 | 10.46 | |
| Sep23/86 | Y | 55.17 | 0.7431 | 0.9226 | 45 | 11.09 | |
| Oct01/86 | Y | 54.19 | 0.2684 | 0.3332 | 44 | 10.52 | |
| Oct07/86 | Y | 47.82 | 0.6574 | 0.8162 | 37 | 11.64 | |
| Oct09/86 | Y | 52.43 | 0.3465 | 0.4302 | 42 | 10.86 | |
| Oct15/86 | Y | 51.35 | 0.6398 | 0.7943 | 42 | 10.14 | |
| Oct21/86 | Y | 49.88 | 0.2191 | 0.2720 | 40 | 10.15 | |
| Dec09/86 | Y | 55.76 | 0.6381 | 0.7922 | 46 | 10.55 | |
| Jan20/87 | Y | 54.10 | 0.5587 | 0.6936 | 44 | 10.79 | |
| Feb03/87 | Y | 61.25 | 0.9800 | 1.2167 | 52 | 10.47 | |

```
                 DAILY INSPECTION OF METHANE DRAINAGE GAS (BM2H) BY TREND LOG DATA
                 =================================================================

POINT NO: 73              DESCRIPTOR: 9 E Drainage CH4         INSTRUMENT TYPE:    BM2H
===========================================================================================

                                   PERFORMANCE SUMMARY
           *************************************************************************
           *                    Average Conspec Reading          Av.    Max.        *
           *  Total             ========================         Local  Error       *
           *  Insp.    Avail.    Mean    STD      95%CL          Value  @95%CL      *
           *====================================================================    *
           *     10      90%    67.06   0.4466   0.5544           59     8.17       *
           *************************************************************************

===========================================================================================
                      Conspec Reading                  Max.
                 ===========================   Local   Error
   Date    Av    Mean      STD      95%CL      Value   @95%CL Comments
===========================================================================================
 Jun04/86   Y    62.72   0.3100   0.3849       54     9.10
 Jun06/86   Y    66.15   0.6000   0.7449       58     8.89
 Jun12/86   Y    57.62   0.2700   0.3352       49     8.96
 Jun16/86   Y    59.89   0.2200   0.2731       51     9.16
 Jun18/86   Y    67.13   0.3500   0.4345       60     7.56
 Jul07/86   Y    69.80   0.2700   0.3352       62     8.14
 Jul30/86   Y    57.62   0.5500   0.6828       49     9.30
 Oct15/86   Y    76.05   0.2191   0.2720       70     6.32
 Feb06/87   Y    86.53   1.2300   1.5270       82     6.06
 Feb18/87   N                                                 Feb18/87 Water in line;
```

## DAILY INSPECTION OF METHANE DRAINAGE GAS (3M2H) BY TREND LOG DATA

POINT NO: 300 DESCRIPTOR: Extraction Plant CH4 INSTRUMENT TYPE: 3M2H

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Max. Error @95%CL |
|---|---|---|---|---|---|---|
| 6 | 100% | 60.59 | 0.3075 | 0.3818 | 54 | 6.81 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Max. Error @95%CL | Comments |
|---|---|---|---|---|---|---|---|
| Jun06/86 | 1 | 62.31 | 0.2000 | 0.2483 | 56 | 6.56 | Lab analysis: 56.1 |
| Jun13/86 | 1 | 66.35 | 0.2600 | 0.3228 | 62 | 4.67 | Lab analysis: 54.4 |
| Aug15/86 | 1 | 54.68 | 0.2684 | 0.3332 | 48 | 7.01 | Lab analysis: 45.3 |
| Aug22/86 | 1 | 58.21 | 0.4100 | 0.5090 | 52 | 6.72 | |
| Oct01/86 | 1 | 58.60 | 0.2684 | 0.3332 | 52 | 6.93 | |
| Mar13/87 | 1 | 63.40 | 0.4382 | 0.5440 | 55 | 8.94 | |

# Appendix 7

```
                      ***************************************************
                      *   OVERALL PERFORMANCE OF BM2H METHANE SENSORS   *
                      *            (Immediate Status Data)              *
                      *=================================================*
                      *   Total Instruments                         3   *
                      *   Total Inspections                        44   *
                      *   Average Error (weighted)               8.63   *
                      *   Availability                            93%   *
                      ***************************************************


                               PERFORMANCE SUMMARY BY INSTRUMENT
================================================================================================

                                                      Mean    Mean      Mean
  Point                             Total             Consp.  Local     Local
   No.   Descriptor                 Insp.    Avail.   Output  Reading   Diff.
================================================================================================
 202/013  10 E Drainage CH4           5      100%     54.40       54    12.40

 043      6 W Drainage CH4            9       89%     46.63       47     9.87

 073      9 E Drainage CH4           30       93%     59.97       60     7.58
```

```
           DAILY INSPECTION OF METHANE DRAINAGE GAS SENSORS (BM2H) BY IMMEDIATE STATUS
           ===========================================================================

POINT NO:  202/13            DESCRIPTOR:   10 E Drainage CH4          INSTRUMENT TYPE:    BM2H
==================================================================================================

                                        PERFORMANCE SUMMARY
                      ****************************************************
                      *                    Mean     Mean      Mean       *
                      *   Total            Consp.   Local     Local      *
                      *   Insp.    Avail.  Output   Reading   Diff.      *
                      *==================================================*
                      *      5     100%    54.40       54     12.40      *
                      ****************************************************

==================================================================================================
                             Local    Local
                   Conspec   Reading  Diff.
  Date      Av     Output    (BM2H)   (BM2H)  Comments
==================================================================================================
 Oct01/86   Y      75.95        47    28.95
 Oct27/86   Y      63.21        50    13.21   Oct17/86 Control unit and sensor changed.
 Nov18/86   Y      61.25        54     7.25   Oct24/86 New point no. 013 (was 202)
 Nov25/86   Y      64.00        57     7.00
 Dec01/86   Y      69.58        64     5.58
```

## DAILY INSPECTION OF METHANE DRAINAGE GAS SENSORS (BM2H) BY IMMEDIATE STATUS

POINT NO: 43 DESCRIPTOR: 6 W Drainage CH4 INSTRUMENT TYPE: BM2H

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Mean Consp. Output | Mean Local Reading | Mean Local Diff. |
|---|---|---|---|---|
| 9 | 89% | 46.63 | 47 | 9.87 |

| Date | Av | Conspec Output | Local Reading (BM2H) | Local Diff. (BM2H) | Comments |
|---|---|---|---|---|---|
| Aug12/86 | Y | 44.10 | 33 | 11.10 | |
| Sep10/86 | Y | 49.49 | 38 | 11.49 | |
| Oct27/86 | Y | 50.47 | 41 | 9.47 | |
| Nov18/86 | N | | | | Nov18/87 Water in pipe line. |
| Nov25/86 | Y | 60.00 | 49 | 11.00 | |
| Dec01/86 | Y | 62.23 | 53 | 9.23 | |
| Dec15/86 | Y | 62.21 | 53 | 9.21 | |
| Jan26/87 | Y | 57.82 | 49 | 8.82 | |
| Feb10/87 | Y | 65.62 | 57 | 8.62 | |

# DAILY INSPECTION OF METHANE DRAINAGE GAS SENSORS (BM2H) BY IMMEDIATE STATUS

POINT NO: 073 DESCRIPTOR: 9 E Drainage CH4 INSTRUMENT TYPE: BM2H

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Mean Consp. Output | Mean Local Reading | Mean Local Diff. |
|---|---|---|---|---|
| 30 | 93% | 59.97 | 60 | 7.58 |

| Date | Av | Conspec Output | Local Reading (BM2H) | Local Diff. (BM2H) | Comments |
|---|---|---|---|---|---|
| Jul15/86 | Y | 70.56 | 64 | 6.56 | |
| Jul21/86 | Y | 61.25 | 53 | 8.25 | |
| Jul31/86 | Y | 57.33 | 57 | 0.33 | |
| Aug06/86 | Y | 56.35 | 47 | 9.35 | |
| Aug11/86 | Y | 53.90 | 45 | 8.90 | |
| Aug15/86 | Y | 59.21 | 51 | 8.21 | Aug15/86 Lab analysis: 51.8%. |
| Aug19/86 | Y | 57.33 | 49 | 8.33 | |
| Aug21/86 | Y | 60.76 | 53 | 7.76 | |
| Aug25/86 | Y | 64.19 | 57 | 7.19 | |
| Aug27/86 | N | | 54 | | |
| Sep02/86 | Y | 63.70 | 56 | 7.70 | |
| Sep09/86 | Y | 67.13 | 53 | 14.13 | |
| Sep17/86 | Y | 65.66 | 58 | 7.66 | |
| Sep22/86 | Y | 60.76 | 54 | 6.76 | |
| Sep25/86 | Y | 68.11 | 62 | 6.11 | |
| Sep30/86 | Y | 72.03 | 65 | 7.03 | |
| Oct02/86 | Y | 67.13 | 59 | 8.13 | |
| Oct06/86 | Y | 70.07 | 63 | 7.07 | |
| Oct08/86 | Y | 63.21 | 57 | 6.21 | |
| Oct16/86 | Y | 66.15 | 61 | 5.15 | |
| Oct20/86 | Y | 72.52 | 65 | 7.52 | |
| Oct23/86 | Y | 75.46 | 70 | 5.46 | |
| Nov15/86 | Y | 73.50 | 66 | 7.50 | |
| Nov17/86 | Y | 73.01 | 65 | 8.01 | |
| Nov24/86 | N | 99.96 | | | Nov24/86 Water in pipe causing incorrect Conspec |
| Nov28/86 | Y | 78.40 | 72 | 6.40 | output;Output at BM2H is 100%. |
| Dec02/86 | Y | 78.40 | 72 | 6.40 | |
| Dec15/86 | Y | 81.39 | 70 | 11.39 | |
| Dec23/86 | Y | 74.48 | 66 | 8.48 | |
| Feb13/87 | Y | 85.26 | 75 | 10.26 | |

# Appendix 8

```
                DAILY INSPECTION OF AMBIENT TEMPERATURE BY TREND LOG
                ===================================================

POINT NO:  107/222            DESCRIPTOR:  Ambient Temperature            INSTRUMENT TYPE:  Thermometer
=========================================================================================================

                                   PERFORMANCE SUMMARY
             ###################################################################
             *                       Average Conspec Reading     Av.      Max.    *
             *  Total                =======================    Tested   Error   *
             *  Insp.     Avail.     Mean     STD      95%CL     Value   @95%CL   *
             *============================================================== *
             *     14      100%      4.35   0.2885   0.3581      4.24     0.38   *
             ###################################################################

=========================================================================================================
                     Conspec Reading                      Max.
               ==========================     Tested     Error
  Date    Av     Mean       STD       95%CL     Value    @95%CL  Comments
=========================================================================================================
 Sep26/86  Y     16.08    0.2136    0.2652     16.11   -0.2952
 Oct03/86  Y     14.13    0.3488    0.4330     14.44   -0.7430
 Oct10/86  Y      8.51    0.2758    0.3424      7.22    1.6324
 Nov05/86  Y      2.43    0.2136    0.2652      2.22    0.4752
 Dec04/86  Y     10.77    0.1744    0.2165      9.89    1.0965
 Dec18/86  Y     -3.11    0.3263    0.4051     -2.50   -1.0151
 Jan07/86  Y      0.48    0.2136    0.2652      0.28    0.4652
 Jan30/86  Y     -4.98    0.2136    0.2652     -5.00    0.2852
 Feb08/87  Y      2.44    0.2540    0.3153      1.94    0.8153
 Feb27/87  Y      0.32    0.2758    0.3424      0.56   -0.5824
 Mar06/87  Y      2.74    0.1744    0.2165                       Mar13/87 Temperature not tested.
 Mar13/87  Y     -1.32    0.4272    0.5304     -2.22    1.4304
 Mar20/87  Y      4.53    0.5785    0.7182      4.44    0.8082
 May29/87  Y      7.90    0.3488    0.4330      7.78    0.5530 May29/87 New point no. 222 (was 107).
```

# Appendix 9

## DAILY INSPECTION OF BAROMETRIC PRESSURE BY TREND LOG DATA

POINT NO: 102/217 DESCRIPTOR: Barometer INSTRUMENT TYPE: Barometer

### PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading |  |  | Weather Office Ave | Average Error |
|---|---|---|---|---|---|---|
|  |  | Mean | STD | 95%CL |  |  |
| 16 | 100% | 30.06 | 0.0071 | 0.0088 | 30.12 | -0.0567 |

| Date | Av | Conspec Reading |  |  | Weather Office Value | Max Error | Comments |
|---|---|---|---|---|---|---|---|
|  |  | Mean | Std. Dev. | 95%CL |  |  |  |
| Aug22/86 | Y | 30.05 | 0.0048 | 0.0060 | 30.12 | -0.0760 | Aug22/86 Test data obtained from Sydney |
| Sep18/86 | Y | 30.06 | 0.0000 | 0.0000 | 30.33 | -0.2700 | Enviroment Canada Office and corrected |
| Sep26/86 | Y | 30.04 | 0.0048 | 0.0060 | 30.11 | -0.0760 | for elevation difference. |
| Oct03/86 | Y | 30.06 | 0.0039 | 0.0048 | 30.17 | -0.1148 |  |
| Oct10/86 | Y | 30.04 | 0.0048 | 0.0060 | 30.19 | -0.1560 |  |
| Nov05/86 | Y | 30.05 | 0.0048 | 0.0060 | 30.13 | -0.0860 |  |
| Dec04/86 | Y | 30.05 | 0.0447 | 0.0555 | 29.60 | 0.5055 |  |
| Dec18/86 | Y | 30.11 | 0.0000 | 0.0000 | 30.52 | -0.4100 |  |
| Jan07/87 | Y | 30.00 | 0.0048 | 0.0060 | 29.92 | 0.0860 |  |
| Jan30/87 | Y | 29.65 | 0.0071 | 0.0088 | 30.02 | -0.3788 |  |
| Feb08/87 | Y | 29.79 | 0.0000 | 0.0000 | 29.96 | -0.1700 |  |
| Feb24/87 | Y | 29.90 | 0.0082 | 0.0102 | 30.49 | -0.6002 |  |
| Mar06/87 | Y | 29.80 | 0.0067 | 0.0083 | 30.00 | -0.2083 |  |
| Mar13/87 | Y | 29.87 | 0.0082 | 0.0102 | 30.35 | -0.4902 |  |
| Mar20/87 | Y | 29.91 | 0.0106 | 0.0132 | 30.02 | -0.2232 |  |
| May29/87 | Y | 31.69 | 0.0000 | 0.0000 | 29.93 | 1.7600 | May29/87 New point no: 217 (was 102).. |

Appendix 10

# DAILY INSPECTION OF FAN WATER GAUGE BY TREND LOG

POINT NO: 101/216 DESCRIPTOR: Fan Water Gauge INSTRUMENT TYPE: Water Gauge

## PERFORMANCE SUMMARY

| Total Insp. | Avail. | Average Conspec Reading Mean | STD | 95%CL | Av. Local Value | Max. Error @95%CL |
|---|---|---|---|---|---|---|
| 13 | 100% | 22.33 | 0.1451 | 0.1801 | 22.16 | 0.2837 |

| Date | Av | Conspec Reading Mean | STD | 95%CL | Local Value | Max. Error @95%CL | Comments |
|---|---|---|---|---|---|---|---|
| Jun13/86 | Y | 22.19 | 0.0000 | 0.0000 | 22.20 | -0.0060 | |
| Aug15/86 | Y | 21.90 | 0.4985 | 0.6189 | 20.90 | 1.6189 | |
| Aug22/86 | Y | 21.90 | 0.0657 | 0.0816 | 22.00 | -0.1816 | |
| Sep18/86 | Y | 22.37 | 0.1230 | 0.1527 | 22.25 | 0.2727 | |
| Sep26/86 | Y | 22.43 | 0.0805 | 0.0999 | 22.25 | 0.2799 | |
| Oct03/86 | Y | 22.11 | 0.0805 | 0.0999 | 22.05 | 0.1599 | |
| Oct10/86 | Y | 22.16 | 0.4335 | 0.5382 | 22.10 | 0.5982 | |
| Nov25/86 | Y | 22.55 | 0.0805 | 0.0999 | 22.60 | -0.1499 | |
| Dec04/86 | Y | 21.75 | 0.1039 | 0.1290 | 21.95 | -0.3290 | |
| Dec18/86 | Y | 22.99 | 0.0805 | 0.0999 | 22.55 | 0.5399 | |
| Jan07/86 | Y | 22.13 | 0.1315 | 0.1633 | 22.30 | -0.3333 | |
| Jan30/86 | Y | 22.93 | 0.1039 | 0.1290 | 22.50 | 0.5590 | |
| Feb08/86 | Y | 22.93 | 0.1039 | 0.1290 | 22.40 | 0.6590 | |

Appendix 11

# Daily System Performance Summary

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Jun 2/86 | ISC Color Pr. | Removed for repairs | 24.00 |
| Jun 3/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.50 |
| Jun 3/86 | ISC Color Pr. | Removed for repairs | 24.00 |
| Jun 4/86 | ISC Color Pr. | Removed for repairs | 24.00 |
| Jun 5/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jun 5/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.50 |
| Jun 5/86 | ISC Color Pr. | Removed for repairs | 24.00 |
| Jun 6/86 | ISC Color Pr. | Printed circuit board burned out | 24.00 |
| Jun 9/86 | ISC Color Pr. | Printed circuit board burned out | 24.00 |
| Jun 12/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jun 18/86 | Senturion 200 | Diagnostics for Canmet outstation. | 1.50 |
| Jun 18/86 | Outstations | Defective Accessor card in Canmet outstation | 1.50 |
| Jun 19/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 20/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 23/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 24/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 25/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.50 |
| Jun 25/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 26/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 27/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 30/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.50 |
| Jun 30/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 2/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 3/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 4/86 | Senturion 200 | Problem with barriers. | 1.00 |
| Jul 4/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 7/86 | Senturion 200 | Problem with barriers. | 2.50 |
| Jul 7/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 8/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 9/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 14/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 15/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 21/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 22/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 23/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 24/86 | Outstations | Canmet's Bat. Backup failed. | 24.00 |
| Jul 25/86 | Outstations | Canmet's Bat. Backup failed. | 24.00 |
| Jul 28/86 | Outstations | Canmet's Bat. Backup failed. | 24.00 |
| Jul 29/86 | Outstations | Canmet's Bat. Backup failed. | 24.00 |
| Jul 30/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 31/86 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Jul 31/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 1/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 4/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 5/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 6/86 | UPS Bat.Backup | Failed during power failure. | 1.00 |
| Aug 6/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 7/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 8/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 11/86 | Outstations | Canmet's Bat. backup unreliable | - |

## Daily System Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Aug 12/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 13/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 14/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 15/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 18/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 19/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 20/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 21/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 22/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 25/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 26/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 27/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 28/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 29/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 2/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 3/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 4/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 5/86 | Outstations | Canmet's Bat. Backup failed. | 2.25 |
| Sep 8/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.25 |
| Sep 8/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 9/86 | Quay 910 | Software problem caused computer to hangup. | 0.50 |
| Sep 9/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 9/86 | Software | "ESA" causes Quay Computer to hang up. | 24.00 |
| Sep 10/86 | Quay 910 | Software problem caused computer to hangup. | 0.50 |
| Sep 10/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 10/86 | Software | "ESA" causes Quay Computer to hang up. | 24.00 |
| Sep 11/86 | Quay 910 | Software problem caused computer to hangup. | 0.50 |
| Sep 11/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 11/86 | Software | "ESA" causes Quay Computer to hang up. | 24.00 |
| Sep 12/86 | Quay 910 | Software problem caused computer to hangup. | 0.50 |
| Sep 12/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 12/86 | Software | "ESA" causes Quay Computer to hang up. | 24.00 |
| Sep 15/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 16/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 17/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 17/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 18/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Sep 18/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 18/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 19/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 19/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 22/86 | Quay 910 | Repeated tries needed for floppy disk | 0.50 |
| Sep 22/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 22/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 23/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 23/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 24/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 24/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 25/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 25/86 | ISC Color Pr. | Ran out of ink. | 24.00 |

## Daily System Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Sep 25/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 26/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 26/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 29/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 29/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 30/86 | Senturion 200 | Problem with monitor. | 3.00 |
| Sep 30/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Oct 1/86 | Senturion 200 | Problem with monitor and floppy disk. | 0.50 |
| Oct 6/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Oct 11/86 | Senturion 200 | New software installed. | 8.00 |
| Oct 22/86 | Senturion 200 | When "SVD" attempted computer crashed. | 0.50 |
| Oct 23/86 | Senturion 200 | New outstations online. | 2.00 |
| Oct 24/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 27/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 28/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 29/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 30/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 31/86 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Oct 31/86 | Quay 910 | Unable to reboot | 24.00 |
| Nov 3/86 | Quay 910 | Unable to reboot | 24.00 |
| Nov 4/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 5/86 | Senturion 200 | Reboot - no apparent reason | 0.22 |
| Nov 5/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 6/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 7/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 7/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 9/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 9/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 9/86 | M.T. Pr. 1 | Blown fuse | 0.50 |
| Nov 10/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 10/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 11/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 11/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 12/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 12/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 14/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 14/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 14/86 | Outstations | New barriers installed in Canmet outstation. | 0.50 |
| Nov 17/86 | Senturion 200 | Communications console was moved. | 0.50 |
| Nov 17/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 17/86 | UPS Bat.Backup | Failed during power failure. | 0.25 |
| Nov 17/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 18/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 18/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 19/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 19/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 20/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 20/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 21/86 | Senturion 200 | Reboot - no apparent reason | 3.25 |
| Nov 21/86 | Quay 910 | Removed for repairs | 24.00 |

## Daily System Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Nov 21/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 23/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 23/86 | Televideo [illegible] | Screen dim - Getting hard to read | - |
| Nov 24/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 24/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 25/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 25/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 26/86 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Nov 26/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 26/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 26/86 | M.T. Pr. 2 | Printer circuit board burned out. | 24.00 |
| Nov 27/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 27/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 27/86 | M.T. Pr. 2 | Printed circuit board burned out | 24.00 |
| Nov 28/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 28/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 28/86 | M.T. Pr. 2 | Printed circuit board burned out | 24.00 |
| Dec 1/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 1/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Dec 1/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 2/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 2/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Dec 2/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 3/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 3/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 4/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 4/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 5/86 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Dec 5/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 5/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 5/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 8/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 8/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 8/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 9/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Dec 9/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 9/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 9/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 10/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 10/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 10/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 11/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 11/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 11/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 12/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 12/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 12/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 15/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 15/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 15/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |

## Daily System Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Dec 16/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 16/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 16/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 17/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 17/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 17/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 18/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 18/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 18/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 19/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 19/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 19/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 22/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 22/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 5/87 | Senturion 200 | Reboot - no apparent reason | 0.25 |
| Jan 5/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 5/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 7/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jan 7/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 7/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 8/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 8/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 9/87 | Senturion 200 | Floppy disk-drive being repaired. | 5.50 |
| Jan 9/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 9/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 12/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 12/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 13/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 14/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jan 14/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 14/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 15/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 15/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 16/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 16/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 19/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 19/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 20/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jan 20/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 21/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 21/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 22/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 22/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 23/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 23/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 26/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 26/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 27/87 | Quay 910 | Removed for repairs | 24.00 |

## Daily System Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Jan 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 28/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 28/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 29/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 29/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 30/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 30/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 30/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 2/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 2/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 2/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 3/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 3/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 3/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 4/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 4/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 4/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 5/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 5/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 5/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 6/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 6/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 6/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 9/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 9/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 9/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 10/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 10/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 11/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 11/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 12/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 12/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 13/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 14/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 14/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 17/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 17/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 18/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 18/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 19/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 19/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 20/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 22/87 | Senturion 200 | Reboot twice - no apparent reason | 1.00 |
| Feb 22/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 22/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 23/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Feb 23/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 23/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |

## Daily System Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Feb 24/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 24/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 25/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 25/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 26/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Feb 26/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 26/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 27/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 2/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 2/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 3/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 3/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 4/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 4/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 5/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 5/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 6/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 6/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 9/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 10/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 11/87 | Senturion 200 | Reboot - New disk-drive installed. | 2.00 |
| Mar 11/87 | UPS Bat.Backup | Unable to operate Quay 910. | 0.50 |
| Mar 11/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 12/87 | M.T. Pr. 1 | No apparent reason. | 3.50 |
| Mar 12/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 15/87 | Senturion 200 | Reboot - no apparent reason | 0.17 |
| Mar 15/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 16/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 17/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 18/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 19/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 23/87 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Mar 23/87 | M.T. Pr. 1 | I.D. Code settings incorrect. | 24.00 |
| Mar 23/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 24/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 25/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 26/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 27/87 | ISC Color Pr. | Needs print head ink gasket (But still operational). | 0.50 |
| Mar 30/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 31/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 1/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 2/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 3/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 3/87 | Outstations | Blown fuses. | 2.00 |
| Apr 6/87 | Quay 910 | Rebooted - no apparent reason for crash | 24.00 |
| Apr 6/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |

## Daily System Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Apr 7/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 8/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 9/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 10/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 14/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 15/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 15/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 16/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 16/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 20/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 21/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 21/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 22/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 22/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 23/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 23/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 24/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 24/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 27/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 28/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 28/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 29/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 29/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 30/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 30/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 1/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 1/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 4/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 4/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 5/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 5/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 6/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 6/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 7/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 7/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 8/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 8/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 8/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| May 11/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 11/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 11/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| May 12/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 12/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 12/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| May 13/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 13/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |

## Daily System Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| May 14/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 14/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 14/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| May 15/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 15/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 19/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 21/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 22/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 25/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 26/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 28/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 29/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |

# Appendix 12

# Component Performance Summary

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Mar 27/87 | ISC Color Pr. | Needs print head ink gasket (But still operational). | 0.50 |
| Jun 6/86 | ISC Color Pr. | Printed circuit board burned out | 24.00 |
| Jun 9/86 | ISC Color Pr. | Printed circuit board burned out | 24.00 |
| Sep 25/86 | ISC Color Pr. | Ran out of ink. | 24.00 |
| Jun 2/86 | ISC Color Pr. | Removed for repairs | 24.00 |
| Jun 3/86 | ISC Color Pr. | Removed for repairs | 24.00 |
| Jun 4/86 | ISC Color Pr. | Removed for repairs | 24.00 |
| Jun 5/86 | ISC Color Pr. | Removed for repairs | 24.00 |
| Nov 9/86 | M.T. Pr. 1 | Blown fuse | 0.50 |
| Mar 23/87 | M.T. Pr. 1 | I.D. Code settings incorrect. | 24.00 |
| Mar 12/87 | M.T. Pr. 1 | No apparent reason. | 3.50 |
| Nov 27/86 | M.T. Pr. 2 | Printed circuit board burned out | 24.00 |
| Nov 28/86 | M.T. Pr. 2 | Printed circuit board burned out | 24.00 |
| Nov 26/86 | M.T. Pr. 2 | Printer circuit board burned out. | 24.00 |
| Dec 1/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 2/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 3/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 4/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 5/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 8/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 9/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 10/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 11/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 12/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 15/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 16/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 17/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 18/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 19/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Dec 22/86 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 5/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 7/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 8/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 9/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 12/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 14/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 15/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 16/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 19/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 21/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 22/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 23/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 26/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 28/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 29/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Jan 30/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |

## Component Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Feb 2/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 3/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 4/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 5/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 6/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 9/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 10/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 11/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 12/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 14/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 17/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 18/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 19/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 22/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 23/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 24/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 25/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 26/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Feb 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 2/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 3/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 4/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 5/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 6/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 9/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 10/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 11/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 12/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 15/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 16/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 17/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 18/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 19/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 23/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 24/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 25/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 26/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 30/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Mar 31/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 1/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 2/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 3/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 6/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 7/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 8/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |

## Component Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Apr 9/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 10/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 14/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 15/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 16/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 21/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 22/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 23/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 24/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 28/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 29/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 30/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 1/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 4/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 5/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 6/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 7/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 8/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 11/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 12/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 13/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 14/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 15/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 19/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 20/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 21/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 22/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 25/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 26/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 27/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 28/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| May 29/87 | M.T. Pr. 2 | Removed for repairs | 24.00 |
| Apr 3/87 | Outstations | Blown fuses. | 2.00 |
| May 8/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| May 11/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| May 12/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| May 13/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| May 14/87 | Outstations | Canmet outstation has intermittent fuse on local trunk. | 24.00 |
| Jul 24/86 | Outstations | Canmet's Bat. Backup failed. | 24.00 |
| Jul 25/86 | Outstations | Canmet's Bat. Backup failed. | 24.00 |
| Jul 28/86 | Outstations | Canmet's Bat. Backup failed. | 24.00 |
| Jul 29/86 | Outstations | Canmet's Bat. Backup failed. | 24.00 |
| Sep 5/86 | Outstations | Canmet's Bat. Backup failed. | 2.25 |
| Jun 19/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 20/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 23/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 24/86 | Outstations | Canmet's Bat. backup unreliable | - |

## Component Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Jun 25/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 26/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 27/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 30/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 2/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 3/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 4/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 7/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 8/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 9/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 14/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 15/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 21/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 22/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 23/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 30/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jul 31/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 1/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 4/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 5/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 6/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 7/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 8/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 11/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 12/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 13/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 14/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 15/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 18/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 19/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 20/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 21/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 22/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 25/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 26/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 27/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 28/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Aug 29/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 2/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 3/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 4/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 8/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 9/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 10/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 11/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 12/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 15/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 16/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 17/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 18/86 | Outstations | Canmet's Bat. backup unreliable | - |

## Component Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Sep 19/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 22/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 23/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 24/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 25/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 26/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Sep 29/86 | Outstations | Canmet's Bat. backup unreliable | - |
| Jun 18/86 | Outstations | Defective Accessor card in Canmet outstation | 1.50 |
| Jan 30/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 2/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 3/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 4/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 5/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 6/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Feb 9/87 | Outstations | Fuses blown in Canmet trunkline, lost outstation. | 24.00 |
| Nov 14/86 | Outstations | New barriers installed in Canmet outstation. | 0.50 |
| Dec 5/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 8/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 9/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 10/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 11/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 12/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 15/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 16/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 17/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 18/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Dec 19/86 | Outstations | Problem driving top and bottom trunk line together | 24.00 |
| Apr 15/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 16/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 20/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 21/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 22/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 23/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 24/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 27/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 28/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 29/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Apr 30/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 1/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 4/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 5/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 6/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 7/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 8/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 11/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 12/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 13/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 14/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| May 15/87 | Quay 910 | Out of service due to construction of new computer room. | 24.00 |
| Jun 3/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.50 |

## Component Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Jun 5/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.50 |
| Jun 25/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.50 |
| Jun 30/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.50 |
| Sep 8/86 | Quay 910 | Rebooted - no apparent reason for crash | 0.25 |
| Apr 6/87 | Quay 910 | Rebooted - no apparent reason for crash | 24.00 |
| Nov 4/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 5/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 6/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 7/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 9/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 10/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 11/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 12/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 14/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 17/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 18/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 19/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 20/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 21/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 23/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 24/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 25/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 26/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 27/86 | Quay 910 | Removed for repairs | 24.00 |
| Nov 28/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 1/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 2/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 3/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 4/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 5/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 8/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 9/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 10/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 11/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 12/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 15/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 16/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 17/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 18/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 19/86 | Quay 910 | Removed for repairs | 24.00 |
| Dec 22/86 | Quay 910 | Removed for repairs | 24.00 |
| Jan 5/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 7/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 8/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 9/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 12/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 13/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 14/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 15/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 16/87 | Quay 910 | Removed for repairs | 24.00 |

## Component Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Jan 19/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 20/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 21/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 22/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 23/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 26/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 27/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 28/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 29/87 | Quay 910 | Removed for repairs | 24.00 |
| Jan 30/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 2/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 3/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 4/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 5/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 6/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 9/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 10/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 11/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 12/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 13/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 14/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 17/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 18/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 19/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 20/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 22/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 23/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 24/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 25/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 26/87 | Quay 910 | Removed for repairs | 24.00 |
| Feb 27/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 2/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 3/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 4/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 5/87 | Quay 910 | Removed for repairs | 24.00 |
| Mar 6/87 | Quay 910 | Removed for repairs | 24.00 |
| Sep 22/86 | Quay 910 | Repeated tries needed for floppy disk | 0.50 |
| Sep 9/86 | Quay 910 | Software problem caused computer to hangup. | 0.50 |
| Sep 10/86 | Quay 910 | Software problem caused computer to hangup. | 0.50 |
| Sep 11/86 | Quay 910 | Software problem caused computer to hangup. | 0.50 |
| Sep 12/86 | Quay 910 | Software problem caused computer to hangup. | 0.50 |
| Oct 24/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 27/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 28/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 29/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 30/86 | Quay 910 | Unable to reboot | 24.00 |
| Oct 31/86 | Quay 910 | Unable to reboot | 24.00 |
| Nov 3/86 | Quay 910 | Unable to reboot | 24.00 |
| Jul 31/86 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Oct 31/86 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |

## Component Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Nov 26/86 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Dec 5/86 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Mar 23/87 | Senturion 200 | Alarm buffer full - reboot needed. | 0.50 |
| Nov 17/86 | Senturion 200 | Communications console was moved. | 0.50 |
| Jun 18/86 | Senturion 200 | Diagnostics for Canmet outstation. | 1.50 |
| Jan 9/87 | Senturion 200 | Floppy disk-drive being repaired. | 5.50 |
| Oct 23/86 | Senturion 200 | New outstations online. | 2.00 |
| Oct 11/86 | Senturion 200 | New software installed. | 8.00 |
| Jul 4/86 | Senturion 200 | Problem with barriers. | 1.00 |
| Jul 7/86 | Senturion 200 | Problem with barriers. | 2.50 |
| Oct 1/86 | Senturion 200 | Problem with monitor and floppy disk. | 0.50 |
| Sep 30/86 | Senturion 200 | Problem with monitor. | 3.00 |
| Feb 22/87 | Senturion 200 | Reboot twice - no apparent reason | 1.00 |
| Mar 11/87 | Senturion 200 | Reboot - New disk-drive installed. | 2.00 |
| Jun 5/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jun 12/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Oct 6/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Nov 5/86 | Senturion 200 | Reboot - no apparent reason | 0.22 |
| Nov 21/86 | Senturion 200 | Reboot - no apparent reason | 3.25 |
| Dec 9/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jan 5/87 | Senturion 200 | Reboot - no apparent reason | 0.25 |
| Jan 7/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jan 14/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Jan 20/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Feb 23/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Feb 26/87 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Mar 15/87 | Senturion 200 | Reboot - no apparent reason | 0.17 |
| Sep 18/86 | Senturion 200 | Reboot - no apparent reason | 0.50 |
| Oct 22/86 | Senturion 200 | When "SVD" attempted computer crashed. | 0.50 |
| Sep 9/86 | Software | "ESA" causes Quay Computer to hang up. | 24.00 |
| Sep 10/86 | Software | "ESA" causes Quay Computer to hang up. | 24.00 |
| Sep 11/86 | Software | "ESA" causes Quay Computer to hang up. | 24.00 |
| Sep 12/86 | Software | "ESA" causes Quay Computer to hang up. | 24.00 |
| Sep 17/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 18/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 19/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 22/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 23/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 24/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 25/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 26/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 29/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Sep 30/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 7/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 9/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 10/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 11/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 12/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 14/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 17/86 | Televideo CRT | Screen dim - Getting hard to read | - |

## Component Performance Summary (contd.)

| Date | Item | Problems Noted. | Hours Downtime |
|---|---|---|---|
| Nov 18/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 19/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 20/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 21/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 23/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 24/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 25/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 26/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 27/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 28/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Dec 1/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Dec 2/86 | Televideo CRT | Screen dim - Getting hard to read | - |
| Nov 17/86 | UPS Bat.Backup | Failed during power failure. | 0.25 |
| Aug 6/86 | UPS Bat.Backup | Failed during power failure. | 1.00 |
| Mar 11/87 | UPS Bat.Backup | Unable to operate Quay 910. | 0.50 |

# Appendix 13

R.O.M. Production (Tonnes) As Reported By Lingan Colliery

| DATE | 6 WEST | | | 9 EAST | | | 10 EAST | | | 8 EAST | | | DEV | DAILY TOTAL | WEEKLY TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SHIFTS | | | SHIFTS | | | SHIFTS | | | SHIFTS | | | | | |
| | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | | | |
| 02-Jun-86 | 843 | 1472 | 1040 | 537 | 1578 | | 773 | 748 | 1119 | | | | 362 | 8472 | |
| 03-Jun-86 | 804 | 1124 | 1253 | 1412 | 1107 | | 1063 | 667 | 803 | | | | 446 | 8679 | |
| 04-Jun-86 | 475 | 801 | 843 | 941 | 1004 | | 1075 | 865 | 1149 | 173 | | | 263 | 7589 | |
| 05-Jun-86 | 652 | 1034 | 542 | 1452 | 1263 | | 692 | 1007 | 1044 | 59 | | | 327 | 8072 | |
| 06-Jun-86 | 503 | 407 | 865 | 676 | 1306 | | 581 | 1187 | 933 | | | | 295 | 6753 | 39565 |
| 09-Jun-86 | 696 | 609 | 870 | | | | 945 | 922 | 1620 | 186 | | 140 | 361 | 6349 | |
| 10-Jun-86 | 853 | 870 | 1018 | | | | 919 | 1801 | 1192 | | | | 360 | 7013 | |
| 11-Jun-86 | | | | | | | | | | | | | | 0 | |
| 12-Jun-86 | 885 | 609 | 934 | | | 1165 | 1471 | 1388 | 900 | | | | 285 | 7637 | |
| 13-Jun-86 | 1053 | 229 | 249 | 899 | | 1192 | 1090 | 1480 | 1236 | | | | 393 | 7821 | 28820 |
| 16-Jun-86 | 424 | 1017 | 828 | | 1714 | 1095 | 1264 | 1980 | 1267 | | | | 230 | 9819 | |
| 17-Jun-86 | 590 | 435 | 893 | | 820 | 1552 | 1092 | 1124 | 1413 | | | | 187 | 8106 | |
| 18-Jun-86 | 424 | 537 | 1079 | | 1292 | 618 | 1172 | 1571 | 745 | | | | 165 | 7599 | |
| 19-Jun-86 | | 486 | 966 | | 1139 | 924 | | 1215 | 1273 | | | | 165 | 6148 | |
| 20-Jun-86 | 435 | 534 | 1150 | | 1438 | 1095 | 1027 | 991 | 920 | | | | 132 | 7722 | 39394 |
| 23-Jun-86 | 411 | 493 | 1052 | 1024 | 829 | | 892 | 1238 | 1167 | | | | 65 | 6971 | |
| 24-Jun-86 | 400 | 230 | 1003 | 1351 | 264 | | 1262 | 315 | 563 | | | | 241 | 5668 | |
| 25-Jun-86 | 477 | 466 | 466 | 1125 | 897 | | 903 | 673 | 1113 | | | | 241 | 6361 | |
| 26-Jun-86 | 756 | 1107 | 806 | 1634 | 1747 | | 969 | 1088 | 1340 | | | | 329 | 9776 | |
| 27-Jun-86 | 400 | 1140 | 504 | 1561 | 1289 | | 881 | 1276 | 893 | | | | 259 | 8013 | 36789 |
| 30-Jun-86 | | | 367 | 733 | 998 | 739 | 1049 | 1087 | 315 | | | | 373 | 5661 | |
| 01-Jul-86 | | | | | | | | | | | | | | 0 | |
| 02-Jul-86 | 242 | 106 | | 667 | 871 | 96 | 847 | 750 | 72 | | | | 176 | 3827 | |
| 03-Jul-86 | | 511 | 490 | | 1412 | 1355 | | 822 | 936 | | | | 110 | 5636 | |
| 04-Jul-86 | 326 | 789 | 805 | 234 | 1282 | 1046 | 1247 | 1140 | 1733 | | | | 132 | 8534 | 23658 |

R.O.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

| | 6 WEST | | | 9 EAST | | | 10 EAST | | | 8 EAST | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SHIFTS | | | SHIFTS | | | SHIFTS | | | SHIFTS | | | | | |
| DATE | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | DAILY TOTAL | WEEKLY TOTAL |
| 07-Jul-86 | 555 | 913 | 459 | | 988 | 932 | 1080 | 1092 | 1146 | | | | 459 | 7624 | |
| 08-Jul-86 | 605 | 104 | | | 285 | | 838 | 64 | | | | | 220 | 2116 | |
| 09-Jul-86 | | 415 | 363 | | 935 | 1100 | | 1353 | 972 | | | | 143 | 5281 | |
| 10-Jul-86 | 156 | 314 | | 303 | 1291 | 1205 | 1200 | 1156 | 1076 | | | | 329 | 7030 | |
| 11-Jul-86 | 698 | 784 | 996 | 482 | 747 | 1247 | 565 | 1175 | 1029 | | | | 220 | 7943 | 29994 |
| 14-Jul-86 | 318 | 773 | 362 | 278 | 1443 | 852 | 1095 | 1538 | 1023 | | | | 165 | 7847 | |
| 15-Jul-86 | 870 | 905 | 587 | 1011 | 1352 | 369 | 842 | 948 | 1198 | | | | 231 | 8313 | |
| 16-Jul-86 | 587 | 1271 | 611 | 1048 | 1451 | | 777 | 1348 | 1420 | | | | 307 | 8820 | |
| 17-Jul-86 | 599 | 946 | 826 | 562 | 1042 | | 1229 | 877 | 671 | | | | 165 | 6917 | |
| 18-Jul-86 | 587 | 587 | | | | | 1329 | 1073 | | | | | 99 | 3675 | 35572 |
| 11-Aug-86 | 347 | 698 | 371 | 168 | 1075 | 825 | 707 | 1218 | 1010 | | | | 231 | 6650 | |
| 12-Aug-86 | 651 | 428 | 713 | 767 | 1290 | 1194 | 852 | 953 | 1155 | | | | 121 | 8124 | |
| 13-Aug-86 | 800 | | 620 | 973 | 1008 | 1360 | 1212 | 1164 | 805 | | | | 231 | 8173 | |
| 14-Aug-86 | 594 | 831 | 684 | 825 | 982 | 1220 | 486 | 284 | 896 | | | | 257 | 7059 | |
| 15-Aug-86 | 371 | 1055 | 356 | 912 | 203 | 1168 | 565 | 148 | 754 | | | | 132 | 5664 | 35670 |
| 18-Aug-86 | 344 | 679 | 340 | | 1143 | 918 | 397 | 645 | 518 | | | | 296 | 5280 | |
| 19-Aug-86 | 344 | | 509 | | 1070 | 560 | 189 | 1051 | 459 | | | | 198 | 4380 | |
| 20-Aug-86 | 363 | 495 | 353 | | 1039 | 1194 | 372 | 970 | 1249 | | | | 285 | 6320 | |
| 21-Aug-86 | 344 | 386 | 532 | 695 | 1222 | 1033 | 753 | 1001 | 772 | | | | 328 | 7066 | |
| 22-Aug-86 | 459 | 92 | 429 | | 1241 | 1194 | 772 | 794 | 676 | | | | 439 | 6096 | 29142 |
| 25-Aug-86 | | 175 | 599 | 727 | 732 | 391 | 877 | 667 | 271 | | | | 231 | 4670 | |
| 26-Aug-86 | 350 | 249 | 814 | 632 | 553 | 391 | 343 | 543 | 624 | | | | 165 | 4664 | |
| 27-Aug-86 | 383 | 766 | | 799 | 1330 | 1045 | 955 | 599 | 658 | | | | 339 | 6874 | |
| 28-Aug-86 | 431 | 599 | 695 | 221 | 981 | 397 | 671 | 1260 | 555 | | | | 262 | 6072 | |
| 29-Aug-86 | 144 | 1176 | | 1191 | 788 | 141 | 1248 | 1092 | 787 | | | | 164 | 6731 | 29011 |

R.O.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

| | 6 WEST | | | 7 EAST | | | 10 EAST | | | 8 EAST | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SHIFTS | | | SHIFTS | | | SHIFTS | | | SHIFTS | | | | | |
| DATE | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | DAILY TOTAL | WEEKLY TOTAL |
| 01-Sep-86 | | | | | | | | | | | | | | 0 | |
| 02-Sep-86 | 448 | 268 | 455 | 565 | 229 | 1191 | 496 | 406 | 1042 | | | | 316 | 5416 | |
| 03-Sep-86 | 287 | 944 | | 794 | 397 | | 924 | 799 | | | | | 262 | 4407 | |
| 04-Sep-86 | 565 | 1518 | 719 | 794 | 257 | 1171 | 973 | 886 | 1610 | | | | 282 | 8775 | |
| 05-Sep-86 | 407 | 733 | 575 | 612 | 397 | 1582 | 1011 | 1329 | 1239 | | | | 326 | 8211 | 26809 |
| | | | | | | | | | | | | | | | |
| 08-Sep-86 | 1048 | 136 | 606 | | 1475 | 1137 | 1069 | 1097 | 1251 | | | | 262 | 8081 | |
| 09-Sep-86 | 658 | 702 | 665 | | 1160 | 1520 | 609 | 1647 | 630 | | | | 207 | 7998 | |
| 10-Sep-86 | 339 | 363 | 702 | 93 | 577 | 799 | 941 | 581 | 1214 | | | | 261 | 5870 | |
| 11-Sep-86 | 47 | 934 | 529 | 332 | 1267 | 951 | 809 | 1397 | 980 | | | | 197 | 7443 | |
| 12-Sep-86 | 585 | 693 | 702 | 189 | 1272 | 681 | 923 | 1094 | 815 | | | | 163 | 7117 | 36509 |
| | | | | | | | | | | | | | | | |
| 15-Sep-86 | 366 | 594 | 541 | 338 | 343 | | 669 | 490 | 1346 | | | | 163 | 4850 | |
| 16-Sep-86 | 361 | 909 | 510 | 636 | 631 | 563 | 1216 | 1153 | 1159 | | | | 359 | 7497 | |
| 17-Sep-86 | 697 | 760 | 851 | 661 | 1194 | 729 | 1164 | 386 | 1268 | | | | 327 | 8237 | |
| 18-Sep-86 | 712 | 717 | 375 | 1219 | 805 | 394 | 936 | 1197 | 1072 | | | | 391 | 7818 | |
| 19-Sep-86 | 758 | 1152 | 952 | 805 | 743 | 456 | 582 | 1180 | 922 | | | | 131 | 7681 | 36083 |
| | | | | | | | | | | | | | | | |
| 22-Sep-86 | 743 | 930 | 443 | 933 | 728 | 1656 | 591 | 604 | 1347 | | | | 163 | 8138 | |
| 23-Sep-86 | 298 | 1255 | 886 | 1155 | 793 | 1761 | 613 | 723 | 682 | | | | 293 | 8459 | |
| 24-Sep-86 | 418 | 738 | 984 | 831 | 772 | 1422 | 345 | 789 | 1096 | | | | 293 | 7688 | |
| 25-Sep-86 | 590 | 999 | 728 | 240 | 954 | 1269 | 1123 | 505 | 1110 | | | | 250 | 7768 | |
| 26-Sep-86 | 723 | 379 | 1294 | 948 | 415 | 819 | 784 | 1071 | 1005 | | | | 261 | 7699 | 39752 |
| | | | | | | | | | | | | | | | |
| 29-Sep-86 | 317 | 345 | | 128 | 702 | 1235 | 334 | 635 | 722 | | | | 198 | 4616 | |
| 30-Sep-86 | | 414 | 702 | 133 | 986 | 122 | 700 | 1083 | 1105 | | | | 260 | 5505 | |
| 01-Oct-86 | 313 | 642 | 685 | 177 | 357 | 548 | 449 | 717 | 1165 | | | | 219 | 5272 | |
| 02-Oct-86 | 338 | 1028 | 534 | | 1172 | 1157 | 749 | 903 | 982 | | | | 283 | 7146 | |
| 03-Oct-86 | | 826 | 692 | 577 | 974 | 1056 | 801 | 1061 | 613 | | | | 131 | 6731 | 29270 |

R.O.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

|  | 6 WEST |  |  | 9 EAST |  |  | 10 EAST |  |  | 8 EAST |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | SHIFTS |  |  | SHIFTS |  |  | SHIFTS |  |  | SHIFTS |  |  |  | DAILY | WEEKLY |
| DATE | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | TOTAL | TOTAL |
| 06-Oct-86 | 357 | 218 |  | 895 | 950 | 998 | 592 | 883 | 874 |  |  |  | 370 | 6137 |  |
| 07-Oct-86 | 279 |  |  | 812 |  |  | 713 |  |  |  |  |  | 190 | 1994 |  |
| 08-Oct-86 | 165 | 1014 |  | 1027 | 1198 | 701 | 1130 | 794 | 1271 |  |  |  | 252 | 7552 |  |
| 09-Oct-86 | 479 | 224 |  | 329 | 709 | 738 | 644 | 1003 | 891 |  |  |  | 308 | 5325 |  |
| 10-Oct-86 | 520 | 502 |  | 998 | 912 | 435 | 957 | 1133 | 771 |  |  |  | 327 | 6555 | 27563 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13-Oct-86 |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |
| 14-Oct-86 | 569 | 472 | 374 | 655 | 1004 | 1213 | 942 | 987 | 123 |  |  |  | 339 | 6878 |  |
| 15-Oct-86 | 417 | 649 | 370 | 1032 | 472 | 978 |  |  | 1152 |  |  |  | 464 | 5534 |  |
| 16-Oct-86 | 356 | 356 | 557 | 400 | 526 | 466 | 315 | 1071 | 1008 |  |  |  | 359 | 5414 |  |
| 17-Oct-86 | 472 | 507 | 640 | 689 | 927 | 755 | 852 | 1479 | 990 |  |  |  | 414 | 7725 | 25551 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20-Oct-86 |  | 727 | 371 | 814 | 658 |  | 1284 | 758 | 1201 |  |  |  | 175 | 5988 |  |
| 21-Oct-86 |  | 371 | 204 | 819 | 1350 | 1448 | 1265 | 1658 | 926 |  |  |  | 489 | 8530 |  |
| 22-Oct-86 |  | 533 | 737 | 626 | 730 | 1287 | 995 |  | 552 |  |  |  | 469 | 5929 |  |
| 23-Oct-86 |  | 49 |  | 663 | 589 |  | 1073 | 1173 |  |  |  |  | 391 | 3943 |  |
| 24-Oct-86 | 737 | 368 | 368 | 733 | 589 | 1166 | 991 | 900 | 1097 |  |  |  | 413 | 7363 | 31753 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 27-Oct-86 |  | 734 | 52 | 1050 | 958 | 1050 | 945 | 1503 | 1001 |  |  |  | 294 | 8387 |  |
| 28-Oct-86 | 319 | 921 | 160 | 860 | 626 | 776 | 1642 | 1059 | 1163 |  |  |  | 435 | 7961 |  |
| 29-Oct-86 | 25 | 653 | 464 | 1050 | 539 | 1160 | 922 | 1265 | 1033 |  |  |  | 424 | 7385 |  |
| 30-Oct-86 | 307 | 734 | 592 | 652 | 1235 | 792 | 767 | 1236 | 1014 |  |  |  | 175 | 7502 |  |
| 31-Oct-86 | 712 | 876 |  | 964 | 860 | 819 | 1217 | 1233 | 1154 |  |  |  | 132 | 7967 | 39202 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 03-Nov-86 | 567 | 829 | 606 | 376 |  | 376 | 977 | 999 | 1163 |  |  |  | 130 | 6023 |  |
| 04-Nov-86 | 423 | 338 | 686 | 641 | 488 | 1367 | 665 | 1118 | 825 |  |  |  | 295 | 7046 |  |
| 05-Nov-86 | 811 | 574 | 206 | 615 | 615 | 1134 | 651 | 1165 | 734 |  |  |  | 295 | 6821 |  |
| 06-Nov-86 | 686 |  | 631 | 753 | 753 | 1242 | 828 | 1035 | 1406 |  |  |  | 460 | 7792 |  |
| 07-Nov-86 | 875 |  | 674 | 859 | 753 | 1129 | 865 | 865 | 1063 |  |  |  | 164 | 7247 | 34929 |

F.C.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

| | 6 WEST | | | 9 EAST | | | 12 EAST | | | 8 EAST | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SHIFTS | | | SHIFTS | | | SHIFTS | | | SHIFTS | | | | | |
| DATE | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | DAILY TOTAL | WEEKLY TOTAL |
| 10-Nov-86 | | 275 | 371 | 933 | 949 | 788 | 680 | 1192 | 671 | | | | 228 | 6087 | |
| 11-Nov-86 | | | | | | | | | | | | | | 0 | |
| 12-Nov-86 | 45 | 338 | 203 | 374 | 964 | 669 | 782 | 1124 | 711 | | | | 295 | 5505 | |
| 13-Nov-86 | | 428 | 428 | 696 | 1020 | 532 | 950 | 1208 | 723 | | | | 318 | 6305 | |
| 14-Nov-86 | 482 | 486 | 662 | 690 | 854 | 163 | 792 | 1276 | 584 | | | | 294 | 6283 | 24180 |
| 17-Nov-86 | 196 | 777 | 120 | 766 | 398 | 792 | 1348 | 899 | 1348 | | | | 311 | 6955 | |
| 18-Nov-86 | 263 | 504 | 306 | 474 | 413 | 938 | 519 | 1279 | 1323 | | | | 230 | 6249 | |
| 19-Nov-86 | 760 | 454 | 359 | 567 | 864 | 853 | 1424 | 1285 | 1225 | | | | 523 | 8314 | |
| 20-Nov-86 | 693 | 717 | 502 | 488 | 641 | 458 | 573 | 1696 | 782 | | | | 392 | 6942 | |
| 21-Nov-86 | 170 | 765 | | 723 | 1325 | | 1048 | 899 | | | | | 489 | 5419 | 33879 |
| 24-Nov-86 | 336 | 249 | 782 | 552 | 673 | 765 | 480 | 1169 | 750 | | | | 294 | 6050 | |
| 25-Nov-86 | 371 | | 391 | 604 | 1058 | 811 | 1366 | 1372 | 1028 | | | | 523 | 7524 | |
| 26-Nov-86 | 722 | | 448 | 414 | 805 | 713 | 960 | 960 | 1281 | | | | 295 | 6598 | |
| 27-Nov-86 | 369 | | 1043 | 661 | 679 | 914 | 1119 | 1169 | 960 | | | | 360 | 7274 | |
| 28-Nov-86 | 578 | | 391 | 1173 | 1104 | 121 | 750 | 1440 | 960 | | | | 261 | 6778 | 34224 |
| 01-Dec-86 | 605 | 552 | 791 | 851 | 845 | 694 | 1249 | 1635 | 481 | | | | 262 | 7965 | |
| 02-Dec-86 | | 454 | 387 | 467 | 767 | 695 | 961 | 961 | 1185 | | | | 197 | 6074 | |
| 03-Dec-86 | | 366 | 494 | 698 | 896 | 1030 | 985 | 1263 | 1374 | | | | 165 | 7271 | |
| 04-Dec-66 | | 816 | 602 | 54 | 1276 | 1180 | 339 | 1584 | 961 | | | | 196 | 7008 | |
| 05-Dec-66 | 728 | 653 | 954 | 1072 | 1030 | 1272 | 1442 | 1442 | 1442 | | | | 163 | 10198 | 38516 |
| 08-Dec-86 | 583 | 689 | 417 | 915 | 799 | 1429 | 1295 | 1092 | 1136 | | | | 197 | 8552 | |
| 09-Dec-86 | 375 | 566 | 541 | 764 | 537 | 813 | 1264 | 960 | 690 | | | | 163 | 6673 | |
| 10-Dec-86 | 561 | 556 | | 741 | 1330 | 1232 | 892 | 1298 | 1028 | | | | 392 | 8030 | |
| 11-Dec-86 | 494 | 714 | 321 | 674 | 854 | 912 | 1102 | 1440 | 960 | | | | 327 | 7798 | |
| 12-Dec-86 | 692 | | 99 | 349 | 755 | 1342 | 902 | 1017 | 811 | | | | 261 | 6228 | 37281 |

R.O.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

| | 6 WEST | | | 9 EAST | | | 10 EAST | | | 8 EAST | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | SHIFTS | | | SHIFTS | | | SHIFTS | | | SHIFTS | | | | | |
| DATE | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | DAILY TOTAL | WEEKLY TOTAL |
| 15-Dec-86 | 359 | 636 | 647 | 1055 | | 161 | 461 | 596 | 1064 | | | | 523 | 5502 | |
| 16-Dec-86 | 378 | 374 | 585 | | 527 | 1267 | 1296 | 665 | 1078 | | | | 361 | 6531 | |
| 17-Dec-86 | 376 | 217 | 508 | 468 | 605 | 1290 | 1234 | 69 | | | | | 262 | 5029 | |
| 18-Dec-86 | 588 | 60 | 672 | 536 | 912 | 1651 | 492 | 984 | 1476 | | | | 382 | 7753 | |
| 19-Dec-86 | 374 | | | 805 | | | 1476 | | | | | | 164 | 2819 | 27634 |
| | | | | | | | | | | | | | | | |
| 22-Dec-86 | | 400 | 377 | 720 | 1015 | 779 | 768 | 983 | 1415 | | | | 359 | 6816 | |
| 23-Dec-86 | 75 | 330 | | 779 | 909 | 596 | 1157 | 1322 | 1407 | | | | 261 | 6866 | 13682 |
| | | | | | | | | | | | | | | | |
| 05-Jan-87 | 269 | 46 | 422 | 417 | 148 | 964 | 491 | | | | | | 228 | 2985 | |
| 06-Jan-87 | 272 | 425 | 207 | 661 | 970 | 939 | | 1038 | 1514 | | | | 394 | 6420 | |
| 07-Jan-87 | 191 | 67 | 686 | 439 | 865 | 1316 | 768 | 1067 | 1337 | | | | 424 | 7160 | |
| 08-Jan-87 | | 97 | 404 | 439 | 1625 | 1137 | 1372 | 1514 | 2019 | | | | 489 | 9096 | |
| 09-Jan-87 | 282 | 129 | 78 | 494 | 1001 | 476 | 736 | 1287 | 1557 | | | | 588 | 6628 | 32289 |
| | | | | | | | | | | | | | | | |
| 12-Jan-87 | 326 | 212 | 389 | 898 | 1546 | 850 | 1011 | 1517 | 1274 | | | | 458 | 8481 | |
| 13-Jan-87 | | 59 | 253 | 469 | 1537 | 859 | 951 | 1299 | 701 | | | | 462 | 6590 | |
| 14-Jan-87 | 71 | 17 | | 430 | 1283 | 1219 | 829 | 1652 | 2022 | | | | 229 | 7752 | |
| 15-Jan-87 | 687 | 47 | 236 | 923 | 678 | 859 | 1011 | 676 | 1314 | | | | 198 | 6629 | |
| 16-Jan-87 | 61 | 52 | 609 | 859 | 859 | 678 | 708 | 1816 | 1502 | | | | 326 | 7470 | 36922 |
| | | | | | | | | | | | | | | | |
| 19-Jan-87 | 94 | 596 | | 545 | 992 | 1640 | 1049 | 1574 | 1574 | | | | 228 | 8292 | |
| 20-Jan-87 | 148 | 499 | 396 | 744 | 91 | 1325 | 1389 | 1456 | 1315 | | | | 326 | 7689 | |
| 21-Jan-87 | 327 | 615 | 353 | 920 | 1016 | 1035 | 916 | 1142 | 1703 | | | | 163 | 8190 | |
| 22-Jan-87 | 353 | 954 | 794 | 1047 | 430 | 1621 | 192 | 2102 | 1737 | | | | 293 | 9523 | |
| 23-Jan-87 | 372 | | 683 | 526 | | | 1430 | | 1508 | | | | | 4519 | 38213 |

R.O.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

|  | 6 WEST |  |  | 9 EAST |  |  | 10 EAST |  |  | 8 EAST |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | SHIFTS |  |  | SHIFTS |  |  | SHIFTS |  |  | SHIFTS |  |  |  |  |  |
| DATE | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | DAILY TOTAL | WEEKLY TOTAL |
| 26-Jan-87 | 209 |  | 471 |  |  |  | 612 | 1879 | 975 |  |  |  | 293 | 4437 |  |
| 27-Jan-87 | 373 | 174 | 480 | 723 | 705 | 893 | 951 | 1363 | 955 |  |  |  | 229 | 6846 |  |
| 28-Jan-87 | 567 | 87 |  | 454 | 821 | 821 | 951 | 1427 | 1420 |  |  |  | 425 | 6973 |  |
| 29-Jan-87 | 512 | 181 | 610 | 699 | 870 | 439 | 958 | 1394 | 884 |  |  |  | 230 | 6777 |  |
| 30-Jan-87 | 340 | 327 | 327 | 1029 | 410 | 1043 | 722 | 1484 | 1152 |  |  |  | 425 | 7257 | 32290 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 02-Feb-87 | 354 | 699 | 9 | 582 | 651 | 779 | 1085 | 1397 | 1012 |  |  |  | 327 | 6895 |  |
| 03-Feb-87 | 703 | 24 | 47 | 529 | 983 | 1080 | 1264 | 1771 | 1183 |  |  |  | 261 | 7645 |  |
| 04-Feb-87 | 637 | 717 | 715 | 444 | 1177 | 1045 | 924 | 1127 | 1239 |  |  |  | 261 | 8286 |  |
| 05-Feb-87 | 7 | 1053 | 713 | 444 | 100 | 1227 | 1463 | 1246 | 1215 |  |  |  | 361 | 7829 |  |
| 06-Feb-87 | 54 | 1069 | 371 | 576 | 889 | 1124 | 1232 | 1281 | 1939 |  |  |  | 424 | 8959 | 39614 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 09-Feb-87 | 721 | 813 | 281 | 672 | 678 |  | 1013 | 1294 | 903 |  |  |  | 358 | 6733 |  |
| 10-Feb-87 | 707 | 1038 |  | 627 | 1208 | 1014 | 1351 | 1145 | 875 |  |  |  | 489 | 8454 |  |
| 11-Feb-87 | 404 | 726 | 269 | 459 | 1576 |  | 1012 | 1369 | 1376 |  |  |  | 294 | 7483 |  |
| 12-Feb-87 | 450 | 106 | 266 | 846 | 1092 | 323 | 787 | 1210 | 1276 |  |  |  | 359 | 6517 |  |
| 13-Feb-87 | 348 | 431 | 535 | 720 | 924 | 252 | 835 | 1738 | 1344 |  |  |  | 358 | 7465 | 36652 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16-Feb-87 | 491 | 734 | 729 | 640 | 969 | 817 | 1192 | 1490 | 1138 |  |  |  | 326 | 8524 |  |
| 17-Feb-87 |  |  | 719 | 719 | 959 | 915 | 991 | 1120 | 991 |  |  |  | 327 | 6741 |  |
| 18-Feb-87 | 374 | 365 | 710 | 959 | 517 | 896 | 792 | 688 | 625 |  |  |  | 391 | 6317 |  |
| 19-Feb-87 |  | 160 | 219 |  | 745 | 483 |  | 592 | 503 |  |  |  | 293 | 3293 |  |
| 20-Feb-87 | 413 | 680 | 365 |  | 476 | 1164 | 72 |  | 94 |  |  |  | 326 | 3588 | 28463 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 23-Feb-87 | 390 | 739 | 273 | 588 | 837 | 907 | 550 | 746 | 476 |  |  |  | 359 | 5855 |  |
| 24-Feb-87 | 875 | 390 | 739 | 885 | 661 | 1235 | 291 |  | 994 |  |  |  | 390 | 6260 |  |
| 25-Feb-87 | 400 | 617 | 946 | 1163 | 1016 | 128 | 1267 | 1264 | 924 |  |  |  | 358 | 7883 |  |
| 26-Feb-87 | 703 | 300 | 946 | 645 | 310 | 978 | 753 |  | 522 |  |  |  | 293 | 5530 |  |
| 27-Feb-87 | 756 | 584 | 468 | 534 | 792 | 1137 | 756 | 1232 | 1117 |  |  |  | 196 | 7560 | 33088 |

R.O.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

| | 6 WEST SHIFTS | | | 9 EAST SHIFTS | | | 12 EAST SHIFTS | | | 8 EAST SHIFTS | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DATE | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | DAILY TOTAL | WEEKLY TOTAL |
| 02-Mar-87 | 300 | 938 | 615 | 528 | 696 | 772 | 1332 | 1561 | 1400 | | | | 391 | 8613 | |
| 03-Mar-87 | 380 | 792 | 693 | 469 | | 1102 | 1195 | 1658 | 1550 | | | | 326 | 8165 | |
| 04-Mar-87 | 469 | 190 | | 172 | 960 | 370 | 1077 | 1088 | 636 | | | | 392 | 5354 | |
| 05-Mar-87 | 602 | | 782 | 627 | 607 | 888 | 1214 | 873 | 1584 | | | | 359 | 7536 | |
| 06-Mar-87 | 599 | 1214 | 1110 | 541 | 809 | 591 | 1047 | 529 | 1532 | | | | 358 | 8330 | 37998 |
| | | | | | | | | | | | | | | | |
| 09-Mar-87 | 385 | 425 | 1043 | 974 | 729 | 1574 | 1432 | 1513 | 1425 | | | | 229 | 9729 | |
| 10-Mar-87 | 203 | | 525 | 916 | 1051 | 735 | 1263 | 1432 | 1550 | | | | 327 | 8004 | |
| 11-Mar-87 | 480 | 1450 | 740 | 802 | 755 | 1174 | 1226 | 1299 | 1439 | | | | 360 | 9703 | |
| 12-Mar-87 | 755 | 705 | 888 | 982 | | 1051 | 1169 | 1384 | 940 | | | | 393 | 8265 | |
| 13-Mar-87 | 1048 | 615 | 1150 | 916 | 1200 | 1380 | 1399 | 1532 | 1151 | | | | 427 | 10818 | 46519 |
| | | | | | | | | | | | | | | | |
| 16-Mar-87 | 487 | 964 | 693 | 948 | 884 | 510 | 1762 | 1230 | 1852 | | | | 296 | 9624 | |
| 17-Mar-87 | | | 918 | 835 | 803 | 1067 | 1532 | 1471 | 1713 | | | | 318 | 8655 | |
| 18-Mar-87 | 236 | 374 | 885 | 809 | 706 | 1102 | 372 | 1307 | 1566 | | | | 426 | 7779 | |
| 19-Mar-87 | 718 | 872 | 1129 | 567 | 371 | 842 | 1274 | 1332 | 1552 | | | | 361 | 9038 | |
| 20-Mar-87 | 641 | 557 | 962 | 564 | 412 | 55 | 966 | 373 | 1259 | | | | 360 | 6147 | 41243 |
| | | | | | | | | | | | | | | | |
| 23-Mar-87 | 351 | 618 | 702 | | 864 | 1122 | 1456 | 1471 | 971 | | | | 229 | 7784 | |
| 24-Mar-87 | 187 | 1217 | 889 | 558 | 564 | 503 | 834 | 308 | 1105 | | | | 360 | 6525 | |
| 25-Mar-87 | 597 | 1252 | 608 | 723 | 383 | 1287 | 1182 | 1142 | 913 | | | | 328 | 8913 | |
| 26-Mar-87 | 388 | 922 | 644 | 454 | | 1741 | 619 | 479 | 1806 | | | | 294 | 7347 | |
| 27-Mar-87 | 424 | 934 | 807 | 628 | 1272 | 215 | 732 | 1604 | 1228 | | | | 360 | 8002 | 38571 |
| | | | | | | | | | | | | | | | |
| 30-Mar-87 | 578 | 761 | 529 | 938 | 1355 | 319 | 971 | 971 | 486 | | | | 327 | 7235 | |
| 31-Mar-87 | 697 | 1026 | 424 | 247 | 726 | 433 | 1244 | 1572 | 565 | | | | 490 | 7426 | |
| 01-Apr-87 | 897 | 1107 | 1290 | 590 | 668 | 445 | 1122 | 1408 | 1220 | | | | 328 | 9275 | |
| 02-Apr-87 | 976 | 714 | 357 | 716 | 476 | 674 | 1019 | 1457 | 1467 | | | | 327 | 8182 | |
| 03-Apr-87 | | | 345 | 409 | 626 | 942 | 1202 | 1359 | 1324 | | | | 229 | 6436 | 38354 |

R.O.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

|  | 6 WEST |  |  | 9 EAST |  |  | 12 EAST |  |  | 8 EAST |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | SHIFTS |  |  | SHIFTS |  |  | SHIFTS |  |  | SHIFTS |  |  |  |  |  |
| DATE | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | DAILY TOTAL | WEEKLY TOTAL |
| 06-Apr-87 | 349 | 386 | 925 | 12 | 152 | 417 | 1281 | 1078 | 1288 |  |  |  | 151 | 6037 |  |
| 07-Apr-87 | 728 | 723 | 1085 | 541 |  | 65 | 1029 | 868 | 1404 |  |  |  | 151 | 6594 |  |
| 08-Apr-87 | 465 | 619 | 627 | 118 | 432 | 453 | 1386 | 697 | 1428 |  |  |  | 219 | 6444 |  |
| 09-Apr-87 | 222 | 482 | 270 | 168 | 294 | 341 | 973 | 1211 | 830 |  |  |  | 186 | 4977 |  |
| 10-Apr-87 |  |  | 362 | 629 | 526 | 908 | 956 | 1239 | 1138 |  |  |  | 220 | 5978 | 30030 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13-Apr-87 | 502 | 987 | 982 | 445 | 366 | 982 | 845 | 823 | 581 |  |  |  | 168 | 6681 |  |
| 14-Apr-87 | 652 | 871 | 810 | 628 | 1165 | 1293 | 724 | 797 | 1272 |  |  |  | 168 | 8380 |  |
| 15-Apr-87 | 343 | 502 | 776 | 939 | 653 | 1074 | 952 | 908 | 1044 |  |  |  | 214 | 7405 |  |
| 16-Apr-87 | 602 | 1090 | 607 | 500 | 708 | 927 | 522 | 882 | 1103 |  |  |  | 170 | 7111 |  |
| 17-Apr-87 |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 | 29577 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20-Apr-87 | 884 | 615 | 871 |  | 835 | 541 | 733 | 1413 | 1479 |  |  |  | 203 | 7574 |  |
| 21-Apr-87 | 736 | 913 | 433 | 809 | 867 | 908 | 952 | 1020 | 1016 |  |  |  | 204 | 7856 |  |
| 22-Apr-87 | 1135 | 956 | 512 | 447 | 438 | 1017 | 953 | 1258 | 869 |  |  |  | 153 | 7738 |  |
| 23-Apr-87 | 1164 | 1101 | 700 | 500 | 670 | 823 | 1248 | 1266 | 925 |  |  |  | 170 | 8167 |  |
| 24-Apr-87 | 1048 | 1019 | 845 | 432 | 1529 | 941 | 557 | 1241 | 1486 |  |  |  | 204 | 9102 | 40437 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 27-Apr-87 | 146 | 66 | 1124 | 65 | 332 | 1352 | 257 | 179 | 1171 |  |  |  | 136 | 4828 |  |
| 28-Apr-87 | 779 | 112 | 966 | 765 | 1279 | 421 | 1085 | 1353 | 1139 |  |  |  | 204 | 7903 |  |
| 29-Apr-87 | 843 | 567 | 516 | 952 | 667 | 546 | 1017 | 511 | 507 |  |  |  | 187 | 6313 |  |
| 30-Apr-87 |  | 626 | 1341 |  | 777 | 1094 |  | 652 | 1167 |  |  |  | 107 | 5762 |  |
| 01-May-87 | 858 | 1150 | 1032 | 842 | 1122 | 1129 | 868 | 1385 | 1014 |  |  |  | 237 | 9595 | 34401 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 04-May-87 |  | 609 | 935 | 636 | 1412 | 1172 | 632 | 824 | 1154 |  |  |  | 136 | 7510 |  |
| 05-May-87 | 666 | 510 | 1096 | 880 | 645 | 625 | 735 | 718 | 1095 |  |  |  | 119 | 7089 |  |
| 06-May-87 | 510 | 1360 | 241 | 647 | 814 | 925 | 1059 | 982 | 1106 |  |  |  | 119 | 7763 |  |
| 07-May-87 | 316 | 1455 | 1083 | 799 | 817 | 1242 | 831 | 1051 | 924 |  |  |  | 119 | 8335 |  |
| 08-May-87 | 764 | 1178 | 241 | 587 | 622 | 527 | 729 | 792 | 982 |  |  |  | 113 | 6492 | 37209 |

R.O.M. Production (Tonnes) As Reported By Lingan Colliery (continued)

| DATE | 6 WEST |  |  | 7 EAST |  |  | 12 EAST |  |  | 8 EAST |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | SHIFTS |  |  | SHIFTS |  |  | SHIFTS |  |  | SHIFTS |  |  |  | DAILY | WEEKLY |
|  | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | 7-3 | 3-11 | 11-7 | DEV | TOTAL | TOTAL |
| 11-May-87 | 1269 | 453 | 1119 | 896 | 1216 | 1145 | 856 | 759 | 1670 |  |  |  | 117 | 9500 |  |
| 12-May-87 | 778 | 927 | 871 | 557 | 868 | 1011 | 738 | 928 | 1528 |  |  |  | 113 | 8319 |  |
| 13-May-87 | 983 | 1306 | 373 | 731 | 554 | 1142 | 911 | 1311 | 1411 |  |  |  | 152 | 8874 |  |
| 14-May-87 | 866 | 813 | 800 | 405 | 617 |  | 1524 | 1125 | 1293 |  |  |  | 67 | 7280 |  |
| 15-May-87 | 288 | 1191 | 885 | 194 | 1216 | 725 | 386 | 1302 | 990 |  |  |  | 52 | 7223 | 41196 |
| 18-May-87 |  |  |  |  |  |  |  |  |  |  |  |  |  | 0 |  |
| 19-May-87 | 660 | 991 | 1031 | 196 | 688 | 311 | 951 | 957 | 479 |  |  |  | 91 | 6355 |  |
| 20-May-87 | 406 | 833 | 767 | 403 | 352 | 894 | 917 | 1292 | 944 |  |  |  | 68 | 6876 |  |
| 21-May-87 | 549 | 696 | 381 | 632 | 866 | 500 | 964 | 991 | 957 |  |  |  | 51 | 6587 |  |
| 22-May-87 | 752 | 671 | 815 | 729 | 22 | 480 | 1078 | 220 | 1078 |  |  |  | 17 | 5864 | 25682 |
| 25-May-87 | 762 | 782 | 747 | 568 | 482 | 623 | 1354 | 1350 | 1361 |  |  |  | 153 | 8182 |  |
| 26-May-87 | 906 | 797 | 864 | 551 | 325 | 363 | 1634 | 810 | 1163 |  |  |  | 137 | 7530 |  |
| 27-May-87 | 316 | 1006 | 545 | 374 | 357 | 299 | 1534 | 1454 | 1541 |  |  |  | 203 | 7629 |  |
| 28-May-87 | 573 | 797 | 862 | 132 | 693 | 196 | 572 | 864 | 1215 |  |  |  | 34 | 5939 |  |
| 29-May-87 | 747 | 642 | 488 | 651 | 629 | 953 | 1026 | 862 | 1323 |  |  |  | 187 | 7508 | 36988 |
| YEARLY TOTALS | 124012 | 135009 | 129839 | 136813 | 160361 | 179731 | 208948 | 242542 | 239969 | 418 | 0 | 140 | 62386 | 1620168 |  |